U. S. DEPARTMENT OF AGRICULTURE.

OFFICE OF EXPERIMENT STATIONS—BULLETIN NO. 149.

A. C. TRUE, Director.

# STUDIES OF THE FOOD OF MAINE LUMBERMEN.

BY

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AND

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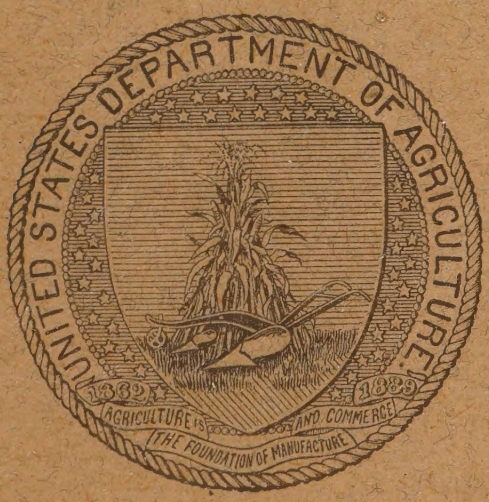


WASHINGTON:

GOVERNMENT PRINTING OFFICE.

1904.

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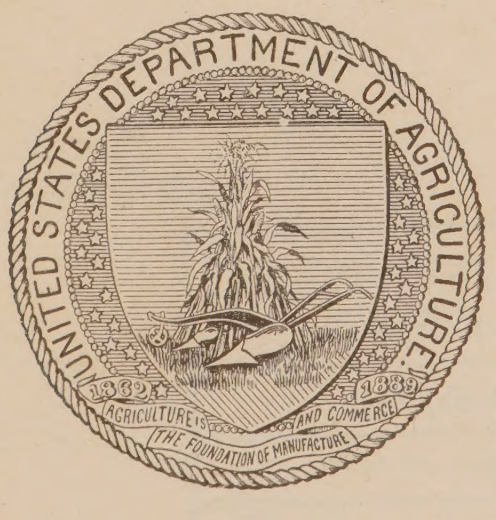


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# LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,
*Washington, D. C., August 15, 1904.*

SIR: I have the honor to transmit herewith a report of studies of the food of Maine lumbermen, carried on by Charles D. Woods, director, and E. R. Mansfield, assistant chemist, of the Maine Agricultural Experiment Station, and recommend that it be published as Bulletin No. 149 of this Office.

Five dietary studies and six digestion experiments were carried on in Maine lumber camps while the men were engaged in severe manual labor. The dietary studies are interesting in themselves and of use in the calculation of dietary standards. The digestion experiments afford data regarding the digestibility of a mixed diet and the effect of severe work upon the quantities of nutrients assimilated.

Acknowledgment should be made to Mr. Thomas Gilbert, of Orono, Me., for the opportunity to carry on the investigations in his lumber camps and for other courtesies.

Respectfully,

A. C. TRUE,
*Director.*

Hon. JAMES WILSON,
*Secretary of Agriculture.*

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# STUDIES OF THE FOOD OF MAINE LUMBERMEN.

## INTRODUCTION.

In the winters of 1901–2 and 1902–3 five dietary studies and six digestion experiments were made of men at work in a typical lumber camp in the Maine woods, situated in the heart of the forest, away from any settlement. Every facility for the successful carrying out of the studies was given by the owner of the lumber property, Mr. Thomas Gilbert, of Orono, and it is believed that the studies here reported are typical of the dietaries of lumbermen in this region. The description of the camp and the surroundings of the men is believed to be typical of the logging camps of the Maine woods where 40 to 60 men are employed.

There has been a gradual change in methods and appliances, but the methods of lumbering in Maine and the management of lumber camps have changed less than in some other regions, the changes in the ways of living being greater than in the lumbering operations themselves. The men are now better fed, better housed, and better paid than formerly. Since the advent of the railroad supplies are more readily obtained, and the improvement in methods of preserving food has made possible in camp many articles that could not formerly be obtained. The demand for labor and the scarcity of men have caused competition not only in wages but also in the food and care of the men while in the woods.

As shown by the results of the food investigations here reported, the diet of the Maine lumbermen consists of a few staple foods, such as bread, salt pork, beans, corned beef, salt fish, some vegetables, a few simple cakes and other pastry, molasses, and tea. Though more generous, it agrees quite closely in character with that observed by Thoreau on his trip to the Maine woods in 1846.[a] "The loggers' fare," he says, "consists of tea, molasses, flour, pork (sometimes beef), and beans. * * * On expeditions it is only hard bread and pork, often raw, slice upon slice, with tea or water as the case may be." At that time cake and such articles were apparently not a part of the lumber camp diet, for, commenting on the great abundance of "sweet cakes" on the tables of public houses near the lumber region,

[a] The Maine Woods, Boston, 1877, pp. 10, 19, 45.

Thoreau says that "when the lumberers come out from the woods they have a craving for cakes and pies, and such sweet things, which are there almost unknown." Black tea, he further states, is indispensable to the loggers.

## THE LUMBER CAMP.

The character of the diet of any family or group is determined by their surroundings, market facilities, and similar factors, and to a marked extent by previously acquired food habits. When the food supply is adequate the amounts which will be consumed are, it is generally conceded, influenced by the kind and amount of work performed more than by any other factor. Such conditions must have a decided bearing upon the diet of a group like that included in the present investigation. Furthermore, the length of time the lumbermen have been in the woods undoubtedly has an effect upon their appetite. At the beginning of the winter the food is more or less novel and seems to be eaten with greater relish than later in the season. Exposure to cold and wet and the hardships which are a necessary part of some of the lumbering operations, it would seem must also exercise an effect upon their appetite and the character and amount of food eaten. In order to judge of the effect of such conditions upon the diet of the Maine lumbermen some statements seem desirable regarding their surroundings, the kind of work involved in the lumbering operations, and the conditions under which it is performed.

The site for the camp (Pl. I, fig. 1) where the men spend their time when not at work, and where their food is prepared and most of the meals are eaten is chiefly determined by its relation to the timber which is to be cut, although it must be close to a water supply, either spring or mountain brook. A complete lumber camp usually consists of the main camp where the men live, the office which is given up to the overseer, clerk, and visitors, the hovel or stable, the blacksmith shop, and the bean hole. The walls or "body" of the main camp are made of long logs notched at the ends and placed horizontally, the spaces between the logs being chinked with sphagnum moss, or sometimes with excelsior if moss can not be conveniently obtained. The roof is made of cedar splits resting on rafters and is covered with tarred paper. The entrances to the buildings are in the end, and the main camp is almost invariably so placed that the main entrance faces the south, and is divided into the men's camp, the cookroom, and the dingle. The men's camp contains the bunks, deacon seats, stoves, water barrel, and general stores. The bunks are arranged in two tiers, one above the other, along both sides of the camp. The bottom of the bunks is made of poles and in the case of the lower tier is a foot or so above the floor. The lower bunks extend from the ground to a height of about 4 feet and the second tier to the roof. The bunks

FIG. 1.—THE MEN'S CAMP.

FIG. 2.—THE BEAN HOLE WHERE BEANS ARE COOKED.

FIG. 1.—A GROUP OF LUMBERMEN STUDIED.

FIG. 2.—LUMBERMEN AT TABLE.

really make a series of wide beds extending the length of the camp. The men sleep with their heads toward the side (wall) of the camp and their feet toward the center. The amount of space per man will naturally vary with the number in the camp. In case of a full camp each man will have a little more than 2 feet. There are no fixed partitions, but the men build them in temporarily, usually two or more men sharing their combined space. The bottom of the bunk is filled with excelsior, boughs, hay, or straw, and above this are placed the two 6-foot blankets, or as they are called "spreads," that are loaned each man. The stoves for the men's camp are of the ordinary box style, and are kept very hot from the time the men come from work at night until they go to bed. The deacon seats are benches made of partially hewn logs placed about 2 feet from the floor and extending the length of the bunks and immediately in front of them. They serve as chairs, but as there is no back to them they are not very comfortable.

A cookroom serves as a combined cooking and eating room (Pl. II, fig. 2). The framework of the table in it is made of poles, and the top of boards. These boards, the cook's bread board and usually some boards from old packing boxes, are the only sawed lumber in a camp. Enameled cloth is used to cover the table. The dishes, chiefly plates and dippers, are all tin, and the knives and forks are steel. Benches made from split logs with stakes for legs serve as seats at table. Breakfast and supper are eaten in the cookroom, but dinner is eaten in the woods when the men are at work.

The cookroom contains small quantities of all the raw materials which are needed for preparing the food and all the necessary equipment of a kitchen, as well as the bunks of the cooks and "cookees," as the cook's assistants are called. As a rule the cooks and cookees are men, for in Maine lumbering operations women cooks have not been at all common, and there are even fewer now than in the past.

The dingle is a lean-to shed adjoining the cookroom, and serves as a sort of storehouse in which all bulky food supplies are kept.

### THE BEAN HOLE AND THE METHOD OF COOKING BEANS.

As will be seen by a glance at the kinds of food used in the dietaries, baked beans were the most important single article of diet. The beans are not baked in the cookroom, but in the bean hole, which is simply a hole in the ground protected by a small log building (Pl. I, fig. 2). The beans are parboiled during the forenoon in an ordinary iron kettle on the stove in the cookroom. The bean pot in which they are baked is of iron with an overhanging iron cover, and it is filled with alternate layers of salt pork and parboiled beans. A fire is then built in the bean hole with both soft and hard wood to a depth of 2 feet, and when well under way is covered with stones and old iron, when the covered pot of beans is suspended over the fire. By the time the pot of beans has been heated to the boiling point the

fire is burned to coals, and the stones and pieces of iron are red hot. The pot of beans is then placed directly upon these, covered with hot ashes and earth and left to cook overnight, usually twelve to fourteen hours. In the morning the beans come from the hole steaming hot and are served for breakfast.

### SOUR-DOUGH BISCUIT.

In the Maine lumber camps cream-of-tartar biscuit are seldom seen, but in place of these the cook makes what are termed sour-dough biscuits. The method of preparing this sour dough is as follows: In the fall of the year, at the beginning of the lumbering operations, flour, water, and lard are mixed to a stiff batter and allowed to remain near the fire from twelve to twenty-four hours. At the end of this time active fermentation (due to wild yeasts) has taken place, and the dough has a very pleasant sour taste and smell. This sour dough is turned on the kneading board and soda and salt are worked into it, after which it is shaped into biscuits and baked. Enough dough is mixed at each baking so that some may be left over to serve as a "starter" in souring the dough for the next baking.

## THE LUMBERING OPERATIONS AND THE CHARACTER AND AMOUNT OF WORK INVOLVED.

The work involved in lumbering operations varies at different seasons of the year in character, amount, and conditions under which it is performed. Maine lumbering consists of three distinct operations, viz, cutting and yarding, landing, and driving, each of which involves severe work under more or less trying conditions.

### CUTTING AND YARDING, AND LANDING THE LOGS.

In the early part of the season the trees are felled and the logs drawn and put into piles (yarded) near where the trees stood. Cutting and yarding usually begin the last of September or early in October and end in January before the deep snows come. The logs are drawn to the "yards" on single bobsleds.

The overseer or foreman naturally has less physical labor to perform than the men. He looks over the standing timber and surroundings to see where the lumber can best be drawn to the brook or stream where the driving will begin later. He "spots" the main roads and yards and maintains a general superintendence of all the work. The choppers simply fell the trees, top them off, and cut them into logs of the desired length. The "swampers" clear a roadway so that the teams can get from the main woods to the newly cut logs. The sled-tenders limb, knot, and load the logs; the teamsters draw them to the yards, and the yard-tenders build the yards by putting the logs into piles.

After all the logs for the season are cut and yarded they are next drawn on double bobsleds to the landing on the bank of a stream or pond, the operation being designated "landing," for in Maine practically all the logs, whether destined for paper stock or lumber, are taken to the mills by running water in the natural waterways. During landing all the general management is still in the hands of the foreman. The yardmen clear the yards of snow and load the logs in great piles on the double bob or "wagon" sleds. The teamsters draw the logs from the yards to the landing place, and the landing men unload the logs and build the landing. The scaler surveys the logs, and the road crew keep the roads in good condition for hauling. All the operations involve hard work and long hours.

During these operations the crew live at the main camp. The cook builds the fires and does the cooking. The cookees, in addition to helping the cook, carry the dinners to the men where they may happen to be at work. The "toter," as the man is called who hauls in supplies and attends to similar work, makes more or less frequent trips to the nearest supply point; in the case of the camp studied, a railway station.

## THE DAILY ROUTINE.

The men work six days a week, Sunday being a day of rest from the regular occupation. On a working day the cook rises at 3.45 o'clock, builds the fires, and cooks breakfast, and at 4.45 calls the "cookees." At 5 o'clock the lumbermen are called, breakfast being served at 5.15. Just as soon as the men can see to follow the road the men and horses start to their work, usually about 6 o'clock. Dinner is served by the "cookees" when the men are at work, anywhere from 11 to 12 o'clock. The dinner "hour" is simply long enough for the men to eat and to fill their pipes. The men leave work when it becomes so dark that they can not longer do the work properly. Supper is usually served at 5.30, and at 9 o'clock the lights are all out and most of the men are in bed.

On Sunday no work is done in the woods and the usual routine is varied. The cook rises at 6.30, the men breakfast at 8, eat their dinner at 12, and their supper at 5.30. The retiring hour is 9 o'clock. Sunday is the wash day of the woodsmen, and from daylight to dark the one washtub and washboard of the men's camp are in constant demand.

## DRIVING THE LOGS.

The logs are taken from the woods to the mills in natural waterways, the brooks and streams often forming chains with small lakes, and this operation, perhaps, calls for the greatest physical exertion of any connected with lumbering, while at the same time the work is performed under the most trying conditions, as may be seen from the brief account which follows. About the time the logs are all yarded

the spring rains and thaws commence, the streams open, and, the spring freshets insuring an abundance of water, the operation of driving the logs to the mill begins. The logs, which were piled on the shores of the stream during the winter, are now rolled into the stream and the swiftly moving water carries them rapidly along. As they pass down the stream the logs form "wings" along the banks wherever a projection extends into the stream. Very often—in fact, nearly always—this is a help rather than a hindrance, for were it not for the wings that turn the logs toward the center of the stream a jam would soon be formed which would cause considerable difficulty. There are places along the stream where in spite of the wings jams are to be expected, and at these places men are stationed.

Often jams are formed in spite of the efforts of the drivers to keep the center of the stream clear. When a jam is formed which the driver can not break with his cant dog, he resorts to dynamite. It must be remembered that all the while logs are pouring down the stream from above and it is necessary to work quickly. Frequently the breaking of one log may start the whole jam. If possible that log is cut with an ax. Seldom, however, is the log in such a position that an ax can reach it readily. Then one or more sticks of dynamite are attached to the end of a long pole, a fuse is lighted, and the whole thrust into the water in the immediate vicinity of the logs causing the trouble. Occasionally it is necessary to repeat the operation several times before the whole jam is started. Ever since the jam has formed water and logs are backing up and often form a great "head." Of course, the men who work on these jams are in great danger, and it is not a rare occurrence for a limb to be broken or even for a man to be killed, and at all times the work and the strain are severe.

While the logs are being started from the head of the operations, or from where they were left by the lumbermen the winter before, a logging camp is often near enough at hand for the men to stop there, but as moves are made down the stream tenting out is the method of living. After all the logs have been started from the landing it is necessary for a crew to go along the banks of the stream and "break" all the "wings" and start the stray logs; this is known as "sacking the rear." The purpose is to get every log, and in order to do this men are often wet to their hips. It must be remembered that the snow is still on the ground and the water is ice cold.

At the mouth of a stream that flows into a lake, boom chains made of logs chained together at their ends are stretched, and each end is attached to the bank so as to form a big U at the mouth of the stream. When a boom is filled it is closed, and then a crew of men start with it across the lake, moving it forward by means of head-works much as in the days before steam engines a ship was "warped" from point to point.

On the drive the crew get up at 4.15 a. m. and breakfast at 5. First

lunch is eaten at 9, second lunch at 2, and supper at 7. In case the men work at night an extra meal is eaten at midnight. The drivers sleep in a large tent and usually go to bed as soon as their supper is eaten. On the drive, as in the woods, two blankets, or "spreads," are loaned each man; but the usual practice is for two men to place one pair under them and the other over them. The men almost invariably sleep with hats on. Only their corked shoes are removed, and even if a man be wet to his neck he goes to bed in this way. During the night his clothes dry, and simply putting on his shoes in the morning prepares him for breakfast and work.

After the first few days of the driving the men seldom stop more than one night in a place and the camp moves forward correspondingly. The moving while "driving" on streams is by teams, but on the lakes boats are used. The move is usually made as soon as first lunch is cooked, and on arriving at the new camping ground the men are fed at the usual hour. There is a tent in which the cook's supplies are kept and the mixing board is placed. In it also the cook and "cookees" sleep.

On the drive no tables are used, but when the food is ready for the men the cook cries "Eat 'er up." A knife and tin plate are seized and each man puts his food upon his plate. The tea, which is always a part of the meal, is poured by the "cookees" and then the men sit down wherever they wish and literally proceed to "eat 'er up." At the first and second lunches the food is brought to the men by the "cookees" and they eat wherever they may happen to be at the time.

## THE DIETARY STUDIES.

Three studies of the food eaten by lumbermen at work in the Maine woods were made in the winter and spring of 1901–2, and two additional studies in the winter of 1902–3. The camps of both these winters were located near Lake Onawa in Elliotsville Plantation, Piscataquis County, in the heart of the Maine woods. The camps were about 15 miles from Onawa station on the Canadian Pacific Railroad and about 25 miles from the foot of Moosehead Lake.

The crew in the camps studied was made up almost wholly of French Canadians. The men were for the most part from 25 to 30 years old, of good working weight, generally about 160 pounds, and were an active, rugged set of men at the best age for hard work. On their return to their homes many of them lead a wild life until their winter earnings are gone, but in camp they are strictly temperate and do a full day's work six days in the week.

The men were paid from $26 to $30 per month in addition to their board, the average wages being, perhaps, $28.

Generally speaking, the same men were in at least two of the studies, and many of them were in three or more of them. The initials, birthplace, age, weight, and occupation of the entire crew are given in connection with the report of each study.

All of the details of the work were carried out by one of us (E. R. M.), who lived at the camp with the men during the time of each study. The methods followed in these studies were essentially those explained in a previous publication of this Office[a] and used in the earlier dietary studies.[b]

The general plan included taking an account of all food material in the camp at the beginning, that brought in by the "tote team" during the time of the experiment, and that which remained at the end of the experiment. The cookroom and table wastes were collected, classified so far as possible, weighed, and, together with samples of many of the foods, sent to the Maine station laboratory and analyzed. In every case the amount of a given food material on hand at the beginning and those received during the experiment were added. Whatever was left at the end was subtracted, and the difference showed the amount used. From the statistics thus obtained and the data showing the chemical composition of each material, the amounts of the nutritive ingredients in the food were calculated. The fuel value of the foods was calculated by use of factors,[c] allowing 4 calories for each gram of protein and carbohydrates and 8.9 calories for each gram of fat. The quantities of nutrients and energy in the waste were similarly computed and subtracted from those of the total food to learn the amounts of nutrients in the food actually eaten. An account was kept of the number of persons at each meal, the total number being equivalent to the number of meals for one man.

## COMPOSITION OF THE FOOD MATERIALS.

In connection with the dietary studies the chief food materials were analyzed by the methods adopted by the Association of Official Agricultural Chemists,[d] and their heats of combustion were determined by means of the bomb calorimeter. Some of the less important foods were not analyzed, as it was believed that their composition and heats of combustion could be calculated with sufficient accuracy from former analyses of similar articles. The results of the analyses and the figures assumed in the cases of the food materials which were not analyzed are given in Table 1.

The beef (fresh and corned), pork, sausage, salt codfish, fresh fish, eggs, dairy products, and other animal foods, as well as the wheat flour, rice, oatmeal, sirup, and other vegetable foods were of the usual sort offered in Maine markets.

The lard compound was one of the common commercial brands, and probably contained cotton-seed oil with lard and other animal fat.

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[a] U. S. Dept. Agr., Office of Experiment Stations Bul. 21.

[b] See list of bulletins on cover.

[c] See Connecticut Storrs Station Rpt. 1899, p. 104.

[d] U. S. Dept. Agr., Bureau of Chemistry Bul. 46, revised.

The currant jelly and strawberry jelly were commercial glucose products.

The mince-meat, like that commonly used in the lumber camps, was made from dried apples and corned beef.

TABLE 1.—*Percentage composition of food materials in dietary studies of Maine lumbermen.*

| Food materials. | Reference number. | Refuse. | Water. | Protein. | Fat. | Carbohydrates. | Ash. | Energy per gram.[a] |
|---|---|---|---|---|---|---|---|---|
| ANIMAL FOOD. | | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* | *Calories.* |
| Beef: | | | | | | | | |
| Forequarter, medium fat[b] | 1 | 18.7 | 49.1 | 14.5 | 17.5 | ---------- | 0.7 | 2.225 |
| Corned flank[b] | 2 | 12.1 | 43.7 | 12.9 | 29.2 | ---------- | 2.6 | 3.245 |
| Corned, canned | 3 | -------- | 56.8 | 27.4 | 10.4 | 0.7 | 4.7 | 2.509 |
| Tripe[b] | 4 | -------- | 86.5 | 11.7 | 1.2 | .2 | .3 | .600 |
| Pork: | | | | | | | | |
| Chuck, salt | 5 | -------- | 22.4 | 4.2 | 66.3 | 1.0 | 6.1 | 6.124 |
| Backs, dry salted[b] | 6 | 8.1 | 15.9 | 7.1 | 66.8 | 2.7 | -------- | 6.500 |
| Shoulder, smoked fat[b] | 7 | 20.0 | 21.4 | 12.1 | 42.6 | ---------- | 4.2 | 4.460 |
| Sausage: | | | | | | | | |
| Bologna | 8 | 2.9 | 63.9 | 12.6 | 10.8 | 4.8 | 5.0 | 1.915 |
| Do | 9 | 3.3 | 64.0 | 13.9 | 10.9 | 4.0 | 3.9 | 1.972 |
| Salt pork | 10 | -------- | 42.8 | 7.5 | 40.1 | 7.7 | 1.9 | 4.535 |
| Fish: | | | | | | | | |
| Cod, salt[b] | 11 | 24.9 | 40.2 | 19.0 | .4 | ---------- | 18.5 | .816 |
| Mackerel, pickled[b] | 12 | 19.7 | 34.8 | 13.9 | 21.2 | ---------- | 10.4 | 2.545 |
| Salmon trout, pickled | 13 | 21.2 | 46.6 | 16.2 | 2.8 | .6 | 12.6 | 1.160 |
| Eggs[b] | 14 | 11.2 | 65.5 | 11.9 | 9.3 | ---------- | .9 | 1.353 |
| Dairy products: | | | | | | | | |
| Butter[b] | 15 | -------- | 8.2 | ---------- | 85.9 | ---------- | 5.9 | 7.990 |
| Do | 16 | -------- | 8.5 | .4 | 75.2 | 10.5 | 5.4 | 7.233 |
| Milk, condensed[b] | 17 | -------- | 26.9 | 8.8 | 8.3 | 54.1 | 1.9 | 3.350 |
| Lard compound[b] | 18 | -------- | .2 | ---------- | 99.8 | ---------- | -------- | 9.280 |
| VEGETABLE FOOD. | | | | | | | | |
| Cereals: | | | | | | | | |
| Corn meal[b] | 19 | -------- | 12.5 | 9.2 | 1.9 | 75.4 | 1.0 | 3.645 |
| Oatmeal[b] | 20 | -------- | 7.3 | 16.1 | 7.2 | 67.5 | 1.9 | 4.100 |
| Rice[b] | 21 | -------- | 12.3 | 8.0 | .3 | 79.0 | .4 | 3.595 |
| Wheat flour | 22 | -------- | 10.8 | 10.8 | 1.1 | 76.7 | .6 | 3.830 |
| Do | 23 | -------- | 11.3 | 11.3 | .9 | 75.7 | .8 | 3.840 |
| Do | 24 | -------- | 13.0 | 9.0 | .7 | 77.0 | .3 | 3.824 |
| Sugars: | | | | | | | | |
| Sugar[b] | 25 | -------- | ---------- | ---------- | -------- | 100.0 | -------- | 4.100 |
| Molasses[b] | 26 | -------- | 19.5 | ---------- | -------- | 80.5 | -------- | 3.305 |
| Do | 27 | -------- | 26.5 | 2.3 | -------- | 68.0 | 3.2 | 2.759 |
| Sirup[b] | 28 | -------- | 24.7 | ---------- | -------- | 75.3 | -------- | 3.088 |
| Vegetables; | | | | | | | | |
| Beans, pea | 29 | -------- | 11.6 | 22.8 | 1.5 | 60.4 | 3.7 | 3.850 |
| Beans | 30 | -------- | 13.3 | 20.4 | 1.3 | 61.7 | 3.3 | 3.830 |
| Beets[b] | 30a | 20.0 | 70.0 | 1.3 | .1 | 7.7 | .9 | .380 |
| Cabbage[b] | 31 | 15.0 | 77.7 | 1.4 | .2 | 4.8 | .9 | .275 |
| Carrots[b] | 32 | 20.0 | 70.6 | .9 | .2 | 7.4 | .9 | .360 |
| Onions[b] | 33 | 10.0 | 78.9 | 1.4 | .3 | 8.9 | .5 | .450 |
| Peas[b] | 34 | -------- | 9.5 | 24.6 | 1.0 | 62.0 | 2.9 | 3.645 |
| Potatoes[b] | 35 | 20.0 | 62.6 | 1.8 | .1 | 14.7 | .8 | .685 |
| Turnips[b] | 36 | 30.0 | 62.7 | .9 | .1 | 5.7 | .6 | .275 |
| Fruits: | | | | | | | | |
| Apples, dried[b] | 37 | -------- | 28.1 | 1.6 | 2.2 | 66.1 | 2.0 | 2.980 |
| Apples, fresh[b] | 38 | 25.1 | 63.3 | .3 | .3 | 10.8 | .3 | .485 |
| Prunes[b] | 39 | 15.0 | 19.0 | 1.8 | -------- | 62.2 | 2.0 | 2.620 |
| Raisins[b] | 40 | 10.0 | 31.1 | 2.3 | 3.0 | 68.5 | 3.1 | 3.185 |
| Currant jelly[b] | 41 | -------- | 32.5 | ---------- | -------- | 67.5 | -------- | 2.770 |
| Strawberry jelly[b] | 42 | -------- | 17.0 | ---------- | -------- | 83.0 | -------- | 3.405 |
| MISCELLANEOUS FOOD. | | | | | | | | |
| Mince-meat[b] | 43 | -------- | 27.7 | 6.7 | 1.4 | 60.2 | 4.0 | 2.875 |
| WASTE. | | | | | | | | |
| Beef, cooked, corned | 44 | -------- | 22.7 | 11.1 | 62.0 | 1.2 | 3.0 | 6.440 |
| Beans, baked | 45 | -------- | 27.1 | 15.9 | 10.6 | 42.6 | 3.8 | 3.575 |
| Do | 46 | -------- | 59.6 | 8.1 | 7.5 | 21.7 | 3.1 | 2.055 |
| Cabbage | 47 | -------- | 84.7 | 1.5 | 4.1 | 7.0 | 2.7 | .733 |
| Pudding | 48 | -------- | 36.3 | 3.2 | 4.4 | 54.3 | 1.8 | 2.853 |

[a] When actual determinations were made, this value represents heat of combustion; in other cases calculated fuel value.

[b] Composition assumed.

## TABULATION OF RESULTS.

The tabular statements which follow give the results of the dietary studies in condensed form, but they furnish all the original data from which the results were computed. The price which follows each food material shows the cost of the total quantity at the place of purchase (usually Bangor, Me.), and does not take into account the cost of getting the material into the woods and to the camp. The numbers in parentheses refer to food materials in the table of composition and show the analytical data used in the computation of the nutrients supplied.

In calculating the nutrients in the waste, baked beans were classed as vegetable food, although much of the fat present was doubtless of animal origin. The waste was so small in all of the studies that no considerable error is thus introduced.

## DIETARY STUDY NO. 390.

The study began with supper December 13, 1901, and continued seven days. The lumber crew were engaged in chopping and yarding. The list of the men included in the study, their occupations, the number of meals eaten, and the weights and costs of foods and nutrients are given in the tables which follow:

TABLE 2.—*Data regarding subjects, dietary study No. 390.*

| Name. | Subject of dietary study Nos.— | Place of birth. | Age. | Weight. | Occupation. |
|---|---|---|---|---|---|
| | | | *Years.* | *Pounds.* | |
| C. J | 390, 391, 392, 393 | Maine | 56 | 172 | Overseer. |
| N. G | 390, 391, 392 | do | 27 | 186 | Clerk. |
| E. R. M | 390, 391, 392, 393, 394 | do | 24 | 148 | Chemist. |
| W. D | 390, 391 | Canada | 54 | 172 | Cook. |
| J. M | 390, 391 | do | 18 | 126 | Cookee. |
| A. R | 390 | do | 25 | 146 | Do. |
| T. H | 390, 391, 392 | do | 67 | 215 | Blacksmith. |
| J. T | 390, 391 | do | 54 | 159 | Do. |
| W. C | 390, 393 | Maine | 48 | 167 | Toter. |
| M. B | 390, 392 | Canada | 30 | 148 | Chopper. |
| A. B | 390 | do | 25 | 159 | Do. |
| J. C | 390, 392 | do | 23 | 199 | Do. |
| E. F | 390, 391, 392, 394 | do | 24 | 178 | Do. |
| A. R | 390, 391, 392, 393 | do | 29 | 162 | Do. |
| E. T | 390, 392 | do | 24 | 154 | Do. |
| O. B | 390, 391, 394 | do | 26 | 178 | Swamper. |
| J. C | 390, 391 | do | 22 | 160 | Do. |
| J. G | 390, 391 | do | 26 | 164 | Do. |
| J. H | 390, 391, 392 | do | 29 | 162 | Do. |
| F. K | 390, 391 | do | 25 | 159 | Do. |
| F. M | 390 | do | 25 | 154 | Do. |
| J. M | 390, 391 | do | 28 | 163 | Do. |
| J. M | 390 | do | 24 | 164 | Do. |
| A. P | 390, 391, 392 | do | 24 | 159 | Do. |
| M. P | 390 | do | 29 | 142 | Do. |
| P. P | 390, 391 | do | 27 | 161 | Do. |
| W. R | 390, 392, 394 | do | 29 | 174 | Do. |
| F. R | 390 | do | 26 | 142 | Do. |
| D. R | 390, 391 | do | 23 | 150 | Do. |
| T. R | 390 | do | 26 | 159 | Do. |
| J. St. P | 390, 391 | do | 25 | 159 | Do. |
| C. V | 390 | do | 27 | 174 | Do. |
| J. C | 390, 391, 394 | Maine | 56 | ---------- | Teamster. |
| J. D | 390, 391, 392 | Canada | 26 | 158 | Do. |
| J. P | 390, 391, 392 | do | 26 | 170 | Do. |
| C. T | 390, 391 | Maine | 57 | 196 | Do. |
| A. T | 390, 391 | do | 25 | 147 | Do. |
| C. C | 390 | Canada | 27 | 179 | Sled tender. |
| M. F | 390, 391 | Maine | 26 | 180 | Do. |
| C. T | 390 | Canada | 26 | 159 | Do. |
| E. W | 390, 391, 393 | do | 27 | 176 | Do. |
| T. D | 390 | do | 23 | 160 | Yard roller. |
| G. G | 390 | do | 26 | 160 | Do. |
| F. H | 390, 391 | do | 26 | 159 | Do. |
| F. S | 390 | Maine | 18 | 144 | Do. |
| F. St. P | 390, 391 | Canada | 20 | 159 | Do. |
| T. V | (?) | do | 32 | 125 | Do. |

The number of meals taken was as follows:

| | Meals. |
|---|---|
| Camp crew: | |
| Breakfasts | 311 |
| Dinners | 313 |
| Suppers | 312 |
| Visitors: | |
| Breakfasts | 3 |
| Dinners | 7 |
| Total number of meals | 946 |

Equivalent to 1 man for 315 days.

TABLE 3.—*Weights and cost of food and nutrients in dietary study No. 390.*

| Food consumed during the entire study (7 days.) | | Cost, nutrients, and fuel value of food per man per day. | | | | |
|---|---|---|---|---|---|---|
| Kinds and amounts. | Cost. | Cost. | Protein. | Fat. | Carbohydrates. | Fuel value. |
| ANIMAL FOOD. | | | | | | |
| | *Dollars.* | *Cents.* | *Grams.* | *Grams.* | *Grams.* | *Calories.* |
| Beef: Fore quarter, 80 pounds, $5.60 (1); corned flank, 100 pounds, $7 (2) | 12.60 | 4.0 | 35.3 | 62.3 | ..... | 695 |
| Pork: Salt, 82 pounds, $8.20 (6); smoked shoulders, 108 pounds, $10.26 (7) | 18.46 | 5.9 | 27.2 | 145.2 | ..... | 1,401 |
| Sausage: Bologna, 34.5 pounds, $3.11 (8) | 3.11 | 1.0 | 6.3 | 5.4 | 2.4 | 83 |
| Fish: Cod, 75.5 pounds, $4.53 (11); mackerel, 115 pounds, $6.90 (12); salmon trout, 6 pounds, 36 cents (13) | 11.79 | 3.7 | 45.1 | 35.7 | .1 | 499 |
| Dairy products: Butter, 26 pounds, $4.16 (15); condensed milk, 2 pounds, 15 cents (17) | 4.31 | 1.4 | .3 | 32.4 | 1.6 | 296 |
| Lard compound, 75 pounds, $6.75 (18) | 6.75 | 2.1 | ..... | 107.9 | ..... | 960 |
| Total animal food | 57.02 | 18.1 | 114.2 | 388.9 | 4.1 | 3,935 |
| VEGETABLE FOOD. | | | | | | |
| Cereals: Corn meal, 21 pounds, 53 cents (19); oat meal, 1 pound, 3 cents (20); wheat flour, 368 pounds, $7.36 (22) | 7.92 | 2.5 | 60.3 | 6.5 | 430.5 | 2,021 |
| Sugars: Sugar, 35 pounds, $1.75 (25); molasses, 98 pounds, $2 (26) | 3.75 | 1.2 | ..... | ..... | 164.2 | 656 |
| Vegetables: Beans, 224 pounds, $9.41 (29); onions, 15.5 pounds, 47 cents (33); potatoes, 370 pounds, $4.44 (35); turnips, 24 pounds, 24 cents (36) | 14.56 | 4.6 | 83.8 | 5.4 | 277.4 | 1,493 |
| Fruit: Apples, 10.5 pounds, 17 cents (38); apples, dried, 20 pounds, $1.80 (37); prunes, 51 pounds, $3.06 (39); raisins, 2.5 pounds, 19 cents (40); currant jelly, 32 pounds, $1.92 (41) | 7.14 | 2.2 | 1.9 | .8 | 100.0 | 415 |
| Total vegetable food | 33.37 | 10.5 | 146.0 | 12.7 | 972.1 | 4,585 |
| Total food | 90.39 | 28.6 | 260.2 | 401.6 | 976.2 | 8,520 |
| WASTE. | | | | | | |
| Beef, corned, 9 pounds (44) | ..... | ..... | 1.4 | 7.9 | .2 | 77 |
| Beans, baked, 52 pounds (45) | ..... | ..... | 11.9 | 7.9 | 31.9 | 245 |
| Total waste | ..... | ..... | 13.3 | 15.8 | 32.1 | 322 |
| FOOD ACTUALLY EATEN. | | | | | | |
| Animal food | ..... | 18.1 | 112.8 | 381.0 | 3.9 | 3,858 |
| Vegetable food | ..... | 10.5 | 134.1 | 4.8 | 940.2 | 4,340 |
| Total food eaten | ..... | 28.6 | 246.9 | 385.8 | 944.1 | 8,198 |

## DIETARY STUDY NO. 391.

The study began with supper January 21, 1902, and continued 16 days. The crew were engaged in drawing the logs from the yards

to the landing. The lists of the men included in the study, their occupations, the number of meals eaten, the daily menu, and the weights and costs of foods and nutrients are given in the tables which follow:

TABLE 4.—*Data regarding subjects, dietary study No. 391.*

| Name. | Subject of dietary study Nos.— | Place of birth. | Age. | Weight. | Occupation. |
|---|---|---|---|---|---|
| | | | *Years.* | *Pounds.* | |
| C. J | 390, 391, 392, 393 | Maine | 56 | 170 | Overseer. |
| N. G | 390, 391, 392 | do | 27 | 185 | Clerk. |
| E. R. M | 390, 391, 392, 393, 394 | do | 24 | 148 | Chemist. |
| W. D | 390, 391 | Canada | 54 | 179 | Cook. |
| J. M | 390, 391 | do | 18 | 132 | Cookee. |
| T. H | 390, 391, 392 | do | 67 | 218 | Blacksmith. |
| J. T | 390, 391 | do | 54 | 157 | Do. |
| J. D | 390, 391, 392 | do | 26 | 157 | Main road man. |
| E. F | 390, 391, 392, 394 | do | 24 | 176 | Do. |
| J. M | 390, 391 | do | 28 | 163 | Do. |
| A. P | 390, 391, 392 | do | 24 | 160 | Do. |
| P. P | 390, 391 | do | 27 | 159 | Do. |
| D. R | 390, 391 | do | 23 | 150 | Do. |
| O. B | 390, 391, 394 | do | 26 | 180 | Yard man. |
| J. C | 390, 391 | do | 23 | 204 | Do. |
| M. F | 390, 391 | Maine | 26 | 184 | Do. |
| J. G | 390, 391 | Canada | 25 | 169 | Do. |
| F. K | 390, 391 | do | 25 | 162 | Do. |
| E. W | 390, 391 | do | 27 | 176 | Do. |
| J. C | 390, 391 | Maine | 56 | 147 | Teamster. |
| W. C | 390, 391, 393 | do | 48 | 172 | Do. |
| J. P | 390, 391, 392 | Canada | 26 | 178 | Do. |
| C. T | 390, 391 | Maine | 57 | 199 | Do. |
| A. T | 390, 391 | do | 25 | 149 | Do. |
| J. C | 390, 391 | Canada | 22 | 163 | Landing man. |
| F. H | 390, 391 | do | 26 | 161 | Do. |
| J. H | 390, 391, 392 | do | 29 | 163 | Do. |
| A. R | 390, 391, 392, 393 | do | 29 | 164 | Do. |
| J. St. P | 390, 391 | do | 25 | 149 | Do. |
| F. St. P | 390, 391 | do | 20 | 164 | Do. |

*Daily menu.*

TUESDAY, JANUARY 21, 1902.

Supper.—Fresh-beef smother, mashed potatoes, flour gravy, mashed turnips, loaf bread, butter, molasses cookies, molasses cake, strawberry jelly, tea, sugar.

WEDNESDAY, JANUARY 22.

Breakfast.—Baked beans, biscuit, cold meat, molasses cookies, doughnuts, stewed prunes, butter, tea, sugar.

Dinner.—Baked beans, cold meat, mashed potatoes, mashed turnips, biscuit, butter, sugar cookies, stewed prunes, tea, sugar.

Supper.—Boiled mackerel, cold meat, boiled potatoes, biscuit, loaf bread, butter, sugar cookies, molasses cookies, stewed prunes, strawberry jelly, tea, sugar.

THURSDAY, JANUARY 23.

Breakfast.—Cold meat, biscuit, butter, doughnuts, stewed prunes, mince pie, tea, sugar.

Dinner.—Baked beans, cold meat, biscuit, butter, molasses cookies, sugar cookies, doughnuts, tea.

Supper.—Beef soup, biscuit, butter, molasses cake, sugar cookies, stewed prunes, strawberry jelly, tea, sugar.

FRIDAY, JANUARY 24.

Breakfast.—Beef soup, beans, biscuit, butter, doughnuts, molasses cookies, stewed prunes, apple pie, tea, sugar.

Dinner.—Baked beans, Bologna sausage, cold meat, loaf bread, butter, molasses cookies, sugar cookies, tea.

Supper.—Boiled potatoes, codfish (boiled), biscuit, butter, molasses cookies, sugar cookies, tea, sugar.

SATURDAY, JANUARY 25.

Breakfast.—Baked beans, biscuit, butter, cookies, doughnuts, stewed prunes, strawberry jelly, apple pie, tea, sugar.

Dinner.—Baked beans, cold meat, biscuit, butter, molasses cookies, tea.

Supper.—Boiled potatoes, pork sausage, biscuit, butter, molasses cookies, prune sauce, strawberry jelly, tea, sugar.

SUNDAY, JANUARY 26.

Breakfast.—Baked beans, biscuit, butter, doughnuts, molasses cookies, tea, sugar.

Dinner.—Baked beans, boiled potatoes, cold beef, biscuit, butter, molasses cookies, tea, sugar.

Supper.—Beef soup, biscuit, butter, sugar cookies, doughnuts, stewed prunes, strawberry jelly, tea, sugar.

MONDAY, JANUARY 27.

Breakfast.—Baked beans, beef soup, bread (loaf), butter, doughnuts, molasses cookies, tea, sugar.

Dinner.—Baked beans, brown bread, cold meat, biscuit, butter, molasses cookies, doughnuts, tea.

Supper.—Boiled potatoes, boiled mackerel, biscuit, butter, doughnuts, molasses cookies, currant jelly, stewed prunes, apple pie, tea, sugar.

TUESDAY, JANUARY 28.

Breakfast.—Baked beans, cold meat, biscuit, butter, molasses cookies, doughnuts, tea, sugar.

Dinner.—Baked beans, cold meat, biscuit, butter, molasses cookies, sugar cookies, tea.

Supper.—Boiled potatoes, beef smother, biscuit, butter, molasses cookies, rice.

WEDNESDAY, JANUARY 29.

Breakfast.—Baked beans, biscuit, butter, doughnuts, molasses cookies, tea, apple pie, sugar.

Dinner.—Baked beans, cold meat, biscuit, butter, doughnuts, molasses cookies, tea.

Supper.—Boiled salmon trout, boiled potatoes, biscuit, butter, doughnuts, molasses cookies, stewed prunes, currant jelly, tea.

THURSDAY, JANUARY 30.

Breakfast.—Baked beans, biscuit, butter, doughnuts, molasses cookies, tea.

Dinner.—Baked beans, cold meat, biscuit, butter, doughnuts, molasses cookies, tea.

Supper.—Vegetable soup, biscuit, butter, molasses cookies, doughnuts, sugar cake, tea, sugar.

FRIDAY, JANUARY 31.

Breakfast.—Baked beans, cold meat, biscuit, butter, doughnuts, molasses cookies, tea.

Dinner.—Baked beans, biscuit, butter, doughnuts, molasses cookies, tea.

Supper.—Boiled potatoes, boiled cod, biscuit, butter, doughnuts, molasses cookies, rice, prune sauce, currant jelly, tea, sugar, condensed milk.

SATURDAY, FEBRUARY 1.

Breakfast.—Baked beans, cold meat, biscuit, butter, doughnuts, tea, sugar.

Dinner.—Baked beans, biscuit, butter, sugar cookies, molasses cookies, doughnuts, tea.

Supper.—Beef soup, biscuit, butter, doughnuts, sugar cookies, molasses cookies, prune sauce, currant jelly, tea.

SUNDAY, FEBRUARY 2.

Breakfast.—Baked beans, cold meat, biscuit, butter, doughnuts, molasses cookies, tea.

Dinner.—Baked beans, beef soup, biscuit, butter, doughnuts, molasses cookies, tea, sugar.

Supper.—Pea soup, biscuit, butter, doughnuts, prune sauce, currant jelly, tea, sugar.

MONDAY, FEBRUARY 3.

Breakfast.—Baked beans, Bologna sausage, biscuit, butter, doughnuts, tea, sugar.

Dinner.—Baked beans, Bologna sausage, cold meat, biscuit, butter, doughnuts, tea.

Supper.—Beef soup, biscuit, butter, molasses cookies, apple pie, prune sauce, currant jelly, tea.

TUESDAY, FEBRUARY 4.

Breakfast.—Baked beans, Bologna sausage, biscuit, butter, molasses cookies, stewed prunes, currant jelly, tea, sugar.

Dinner.—Baked beans, cold corned beef, biscuit, butter, sugar cookies, apple pie, prune sauce, currant jelly, tea.

Supper.—Boiled mackerel, cold corned beef, biscuit, butter, sugar cookies, apple pie, prune sauce, currant jelly, tea.

WEDNESDAY, FEBRUARY 5.

Breakfast.—Baked beans, Bologna sausage, biscuit, butter, molasses cookies, doughnuts, apple pie, stewed prunes, currant jelly, tea.

Dinner.—Baked beans, Bologna sausage, biscuit, butter, molasses cookies, tea.

Supper.—Beef soup, biscuit, butter, sugar cookies, sugar cake, tea.

THURSDAY, FEBRUARY 6.

Breakfast.—Baked beans, cold corned beef, biscuit, butter, molasses cookies, doughnuts, tea, sugar.

Dinner.—Baked beans, Bologna sausage, biscuit, butter, sugar cookies, doughnuts, tea.

The number of meals taken was as follows:

| | Meals. |
|---|---|
| Camp crew: | |
| Breakfasts | 491 |
| Dinners | 482 |
| Suppers | 492 |
| Visitors: | |
| Dinners | 10 |
| Total number of meals | 1,475 |

Equivalent to 1 man for 492 days.

TABLE 5.—*Weights and cost of food and nutrients in dietary study No. 391.*

| Food consumed during the entire study (16 days). | | Cost, nutrients, and fuel value of food per man per day. | | | | |
|---|---|---|---|---|---|---|
| Kinds and amounts. | Cost. | Cost. | Protein. | Fat. | Carbohydrates. | Fuel value. |
| ANIMAL FOOD. | *Dols.* | *Cents.* | *Grams.* | *Grams.* | *Grams.* | *Calories.* |
| Beef: Fore quarter, 259 pounds, $18.13 (1); corned flank, 224.5 pounds, $15.72 (2) | 33.85 | 6.9 | 61.4 | 102.3 | ..... | 1,156 |
| Pork: Salt, 82.5 pounds, $8.25 (6) | 8.25 | 1.7 | 5.4 | 50.8 | ..... | 473 |
| Sausage: Bologna, 24 pounds, $2.16 (8); pork, 27.5 pounds, $2.48 (10) | 4.64 | .9 | 4.7 | 12.6 | 3.0 | 143 |
| Fish: Cod, 35 pounds, $2.10 (11); mackerel, 44 pounds, $2.64 (12); salmon, 44 pounds, $2.64 (13) | 7.38 | 1.5 | 18.3 | 9.8 | .2 | 161 |
| Dairy products: Butter, 46 pounds, $7.36 (15); condensed milk, 3 pounds, 23 cents (17) | 7.59 | 1.5 | .2 | 36.6 | 1.5 | 333 |
| Lard compound, 142.5 pounds, $12.83 (18) | 12.83 | 2.6 | ..... | 131.2 | ..... | 1,168 |
| Total animal food | 74.54 | 15.1 | 90.0 | 343.3 | 4.7 | 3,434 |
| VEGETABLE FOOD. | | | | | | |
| Cereals: Corn meal, 12.5 pounds, 31 cents (19); oatmeal, 2 pounds, 7 cents (20); rice, 8 pounds, 32 cents (21); wheat flour, 295 pounds, $5.90 (22); wheat flour, 87 pounds, $1.74 (23) | 8.34 | 1.9 | 40.4 | 4.0 | 285.2 | 1,338 |
| Sugars: Sugar, 138.5 pounds, $6.93 (25); molasses, 150 pounds, $3.12 (26) | 10.05 | 2.0 | ..... | ..... | 239.2 | 957 |
| Vegetables: Beans, 223.5 pounds, $9.39 (29); carrots, 12 pounds, 12 cents (32); peas, 10 pounds, 23 cents (34); potatoes, 171.5 pounds, $2.06 (35); onions, 0.5 pound, 2 cents (33); turnips, 63 pounds, 63 cents (36) | 12.45 | 2.5 | 52.7 | 3.4 | 157.7 | 872 |
| Fruits: Dried apples, 40.5 pounds, $3.65 (37); prunes, 61.5 pounds, $3.69 (39); raisins, 10 pounds, 75 cents (40); currant jelly, 16.5 pounds, 99 cents (41); strawberry jelly, 18.5 pounds, $1.11 (42) | 10.19 | 2.1 | 1.8 | 1.1 | 90.8 | 380 |
| Total vegetable food | 41.03 | 8.5 | 94.9 | 8.5 | 772.9 | 3,547 |
| Total food | 115.57 | 23.6 | 184.9 | 351.8 | 777.6 | 6,981 |
| WASTE. | | | | | | |
| Beef, corned, 24 pounds (44) | ..... | ..... | 2.5 | 13.8 | .3 | 134 |
| Beans, baked, 21 pounds (45) | ..... | ..... | 3.1 | 2.1 | 8.3 | 64 |
| Total waste | ..... | ..... | 5.6 | 15.9 | 8.6 | 198 |
| FOOD ACTUALLY EATEN. | | | | | | |
| Animal food | ..... | 15.1 | 87.5 | 329.5 | 4.4 | 3,300 |
| Vegetable food | ..... | 8.5 | 91.8 | 6.4 | 764.6 | 3,483 |
| Total food eaten | ..... | 23.6 | 179.3 | 335.9 | 769.0 | 6,783 |

## DIETARY STUDY NO. 392.

The study began with supper April 27, 1902, and continued ten days. The crew were engaged in river driving. The list of men in the study, their occupation, the number of meals eaten, the daily menu.

and the weights and costs of foods and nutrients are given in the tables which follow:

TABLE 6.—*Data regarding subjects, dietary study No. 392.*

| Name. | Subject of dietary study Nos.— | Place of birth. | Age. | Weight. | Occupation. |
|---|---|---|---|---|---|
| | | | *Years.* | *Pounds.* | |
| T. G | 391, 392, 393 | Maine | | | Lumberman. |
| C. J | 390, 391, 392, 393 | do | 56 | 168 | Overseer. |
| N. G | 390, 391, 392 | do | 27 | 182 | Clerk. |
| E. R. M | 390, 391, 392, 393, 394 | do | 24 | 150 | Chemist. |
| G. C | 392 | do | 54 | 159 | Cook. |
| W. R | 390, 392, 394 | Canada | 29 | 177 | Cookee. |
| J. T | 392 | do | 23 | 153 | Do. |
| A. F | 392 | do | 24 | 161 | Wagon man. |
| T. H | 390, 391, 392 | do | 68 | 210 | Blacksmith. |
| G. C | 392 | Maine | 31 | 143 | Teamster. |
| C. B | 392 | Canada | 28 | 134 | Driver. |
| L. B | 392 | do | 28 | 153 | Do. |
| M. B | 390, 392 | do | 30 | 142 | Do. |
| N. C | 392 | do | 24 | 154 | Do. |
| D. C | 392 | do | 24 | 168 | Do. |
| P. C | 392 | do | 31 | 176 | Do. |
| J. D | 390, 391, 392 | do | 26 | 151 | Do. |
| N. D | 392 | do | 25 | 147 | Do. |
| J. D | 392 | do | 23 | 141 | Do. |
| C. D | 392 | do | 25 | 159 | Do. |
| C. D | 392 | do | 24 | 150 | Do. |
| H. D | 392 | New Hampshire | 47 | 171 | Do. |
| E. F | 390, 391, 392, 394 | Canada | 24 | 170 | Do. |
| C. G | 392 | Maine | 23 | 154 | Do. |
| J. G | 392 | Canada | 26 | 164 | Do. |
| J. H | 390, 391, 392 | do | 30 | 155 | Do. |
| M. L | 392 | do | 33 | 169 | Do. |
| F. M | 392 | do | 24 | 176 | Do. |
| S. M | 392 | Vermont | 30 | 147 | Do. |
| S. M | 392 | Canada | 29 | 171 | Do. |
| S. P | 392 | do | 24 | 155 | Do. |
| J. P | 390, 391, 392 | do | 26 | 169 | Do. |
| A. P | 390, 391, 392 | do | 24 | 150 | Do. |
| A. R | 390, 391, 392, 393 | do | 29 | 155 | Do. |
| F. St. P | 392 | do | 29 | 145 | Do. |
| H. S | 392 | Maine | 45 | 169 | Do. |
| N. S | 392 | do | 32 | 147 | Do. |
| P. T | 392 | Canada | 25 | 147 | Do. |
| E. T | 390, 392 | do | 24 | 155 | Do. |
| F. W | 392 | do | 31 | 162 | Do. |
| G. W | 392 | do | 27 | 176 | Do. |
| W. W | 392 | do | 27 | 161 | Do |

*Daily menu.*

SUNDAY, APRIL 27, 1902.

Supper.—Pea soup, biscuit, cookies, tea, molasses.

MONDAY, APRIL 28.

Breakfast.—Baked beans, biscuit, cookies, tea, molasses.
First lunch.—Baked beans, biscuit, cookies, tea, molasses.
Second lunch.—Baked beans, biscuit, cookies, tea, molasses.
Supper.—Baked beans, biscuit, soft gingerbread, tea, molasses.

TUESDAY, APRIL 29.

Breafast.—Baked beans, biscuit, cookies, tea, molasses.
First lunch.—Baked beans, biscuit, cookies, tea, molasses.
Second lunch.—Baked beans, biscuit, cookies, tea, molasses.
Supper.—Baked beans, biscuit, cookies, tea, molasses.

WEDNESDAY, APRIL 30.

Breakfast.—Baked beans, biscuit, butter, cookies, tea, molasses.
First lunch.—Baked beans, biscuit, cookies, tea, molasses.
Second lunch.—Baked beans, biscuit, butter, soft gingerbread, tea, molasses.
Supper.—Codfish, potatoes, biscuit, butter, soft gingerbread, tea, molasses.

THURSDAY, MAY 1.

Breakfast.—Baked beans, biscuit, butter, soft gingerbread, tea, molasses.
First lunch.—Baked beans, biscuit, cookies, tea, molasses.
Second lunch.—Baked beans, biscuit, cookies, tea, molasses.
Supper.—Baked beans, codfish, biscuit, cookies, tea, molasses.

FRIDAY, MAY 2.

Breakfast.—Baked beans, biscuit, cookies, tea, molasses.
First lunch.—Baked beans, biscuit, cookies, tea, molasses.
Second lunch.—Baked beans, biscuit, cookies, tea, molasses.
Supper.—Baked beans, biscuit, butter, cookies, soft gingerbread, tea, molasses.

SATURDAY, MAY 3.

Breakfast.—Baked beans, eggs, biscuit, butter, cookies, tea, molasses.
First lunch.—Baked beans, biscuit, butter, cookies, tea, molasses.
Second lunch.—Baked beans, biscuit, butter, cookies, tea, molasses.
Supper.—Boiled corned beef, boiled potatoes, biscuit, butter, cookies, tea, molasses.
Midnight supper.—Baked beans, boiled corned beef, boiled potatoes, biscuit, butter, cookies, tea, molasses.

SUNDAY, MAY 4.

Breakfast.—Baked beans, biscuit, butter, cookies, tea, molasses.
First lunch.—Baked beans, biscuit, butter, cookies, tea, molasses.
Second lunch.—Baked beans, biscuit, butter, cookies, tea, molasses.
Supper.—Boiled corned beef, boiled potatoes, biscuit, butter, cookies, tea, molasses.

MONDAY, MAY 5.

Breakfast.—Baked beans, biscuit, butter, cookies, tea, molasses.
First lunch.—Baked beans, biscuit, butter, cookies, tea, molasses.
Second lunch.—Baked beans, biscuit, butter, cookies, tea, molasses.
Supper.—Boiled codfish, boiled potatoes, biscuit, butter, cookies, tea, molasses.
Midnight supper.—Baked beans, boiled potatoes, biscuit, butter, cookies, tea, molasses.

TUESDAY, MAY 6.

Breakfast.—Baked beans, eggs, biscuit, butter, cookies, tea, molasses.
First lunch.—Baked beans, biscuit, butter, cookies, tea, molasses.
Second lunch.—Baked beans, biscuit, butter, cookies, tea, molasses.
Supper.—Boiled corned beef, boiled potatoes, biscuit, butter, cookies, tea, molasses.

WEDNESDAY, MAY 7.

Breakfast.—Baked beans, biscuit, butter, cookies, tea, molasses.
First lunch.—Baked beans, biscuit, butter, cookies, tea, molasses.
Second lunch.—Baked beans, biscuit, butter, soft gingerbread, cookies, tea, molasses.

The number of meals taken was as follows:

| | Meals. |
|---|---|
| Camp crew: | |
| Breakfasts | 350 |
| First lunches | 333 |
| Second lunches | 333 |
| Suppers | 350 |
| Midnight suppers | 46 |
| Visitors: | |
| Breakfasts | 3 |
| First lunches | 5 |
| Second lunches | 6 |
| Suppers | 5 |
| Total meals | 1,431 |

Equivalent to 4 meals per day for 1 man for 358 days.

TABLE 7.—*Weights and cost of food and nutrients in dietary study No. 392.*

| Food consumed during the entire study (10 days). | | Cost, nutrients, and fuel value of food per man per day. | | | | |
|---|---|---|---|---|---|---|
| Kinds and amounts. | Cost. | Cost. | Protein. | Fat. | Carbohydrates. | Fuel value. |
| ANIMAL FOOD. | *Dols.* | *Cents.* | *Grams.* | *Grams.* | *Grams.* | *Calories.* |
| Beef: Corned flank, 135 pounds, $9.45 (2) | 9.45 | 2.6 | 22.1 | 50.0 | | 533 |
| Pork: Salt, 127 pounds, $12.70 (6) | 12.70 | 3.5 | 11.4 | 107.6 | | 1,003 |
| Fish: Cod, 55 pounds, $3.30 (11) | 3.30 | .9 | 13.2 | .3 | | 55 |
| Eggs: Hens', 42 pounds, $5.13 (14) | 5.13 | 1.4 | 6.3 | 5.0 | | 70 |
| Dairy products: Butter, 14 pounds, $2.24 (15) | 2.24 | .6 | | 15.3 | | 136 |
| Lard compound, 65 pounds, $5.85 (18) | 5.85 | 1.6 | | 82.2 | | 732 |
| Total animal food | 38.67 | 10.6 | 53.0 | 260.4 | | 2,529 |
| VEGETABLE FOOD. | | | | | | |
| Cereals: Wheat flour, 329 pounds, $6.58 (23) | 6.58 | 1.8 | 47.1 | 3.8 | 315.8 | 1,485 |
| Sugars: Molasses, 50 pounds, $1.05 (26) | 1.05 | .3 | | | 51.0 | 204 |
| Vegetables: Beans, 137 pounds, $5.75 (29); peas, 40 pounds, 92 cents (34); potatoes, 120 pounds, $1.44 (35) | 8.11 | 2.3 | 54.8 | 3.3 | 158.8 | 884 |
| Fruits: Raisins, 8 pounds, 60 cents (40) | .60 | .1 | .2 | .3 | 6.9 | 31 |
| Total vegetable food | 16.34 | 4.5 | 102.1 | 7.4 | 532.5 | 2,604 |
| Total food | 55.01 | 15.1 | 155.1 | 267.8 | 532.5 | 5,133 |
| WASTE. | | | | | | |
| Beef, corned, 6 pounds | | | .8 | 4.7 | .1 | 45 |
| Beans, baked, 13 pounds | | | 2.6 | 1.7 | 7.0 | 54 |
| Total waste | | | 3.4 | 6.4 | 7.1 | 99 |
| FOOD ACTUALLY EATEN. | | | | | | |
| Animal food | | 10.6 | 52.2 | 255.7 | | 2,485 |
| Vegetable food | | 4.5 | 99.5 | 5.7 | 525.5 | 2,550 |
| Total food | | 15.1 | 151.7 | 261.4 | 525.5 | 5,035 |

## DIETARY STUDY NO. 393.

The study began with supper November 17, 1902, and continued six days. The crew were engaged in chopping and yarding. The list of the men, their occupation, the number of meals eaten, the daily

menu, and the weights and costs of foods and nutrients are given in the tables which follow:

TABLE 8.—*Data regarding subjects, dietary study No. 393.*

| Name. | Subject of dietary study Nos.— | Place of birth. | Age. | Weight. | Occupation. |
|---|---|---|---|---|---|
| | | | *Years.* | *Pounds.* | |
| C. J | 390, 391, 392, 393 | Maine | 57 | 169 | Overseer. |
| E. C. G | 393, 394 | do | 22 | 133 | Chief clerk. |
| C. C | 393 | do | 22 | 147 | Clerk. |
| E. R. M | 390, 391, 392, 393, 394 | do | 24 | 148 | Chemist. |
| L. P | 393 | do | 49 | 135 | Cook. |
| J. B | 393 | Canada | 18 | 138 | Cookee. |
| F. D | 393 | do | 23 | 156 | Do. |
| D. T | 393 | Maine | 16 | 129 | Do. |
| J. R | 393 | Canada | 32 | 172 | Blacksmith. |
| W. C | 390, 391, 393 | Maine | 49 | 174 | Toter. |
| W. B | 393 | do | 28 | 176 | Chopper. |
| J. B | 393 | Canada | 26 | 169 | Do. |
| E. B | 393 | do | 24 | 179 | Do. |
| H. D | 393 | do | 25 | 176 | Do. |
| T. D | 393 | do | 23 | 170 | Do. |
| J. L | 393 | do | 24 | 150 | Do. |
| E. T | 393 | do | 26 | 163 | Do. |
| A. V | 393 | do | 25 | 173 | Swamper. |
| F. W | 393 | do | 27 | 181 | Do. |
| A. W | 393 | do | 24 | 176 | Do. |
| A. A | 393 | do | 24 | 173 | Do. |
| F. B | 393 | do | 20 | 154 | Do. |
| O. C | 393 | do | 25 | 161 | Do. |
| B. C | 393 | do | 29 | 159 | Do. |
| O. C | 393 | do | 27 | 157 | Do. |
| F. G | 393 | do | 23 | 159 | Do. |
| A. G | 393 | do | 26 | 172 | Do. |
| A. L | 393 | do | 23 | 168 | Do. |
| J. L | 393 | do | 21 | 148 | Do. |
| A. R | 390, 391, 392, 393 | do | 30 | 157 | Do. |
| G. R | 393 | do | 24 | 167 | Do. |
| P. R | 393 | do | 25 | 159 | Do. |
| D. T | 393 | do | 59 | 185 | Do. |
| M. V | 393 | do | 29 | 131 | Do. |
| J. W | 393 | do | 29 | 129 | Do. |
| J. B | 393 | do | 25 | 139 | Teamster. |
| F. B | 393 | do | 28 | 142 | Do. |
| C. B | 393 | Maine | 37 | 162 | Do. |
| G. C | 393 | do | 29 | 147 | Do. |
| I. G | 393 | do | 21 | 154 | Do. |
| H. H | 393 | Canada | 28 | 179 | Sled tender. |
| A. M | 393 | do | 25 | 163 | Do. |
| J. M | 393 | do | 27 | 158 | Do. |
| J. S | 393 | do | 24 | 167 | Do. |
| E. W | 390, 391, 393 | do | 27 | 174 | Do. |
| J. A | 393 | do | 23 | 165 | Yard roller. |
| S. B | 393 | do | 26 | 154 | Do. |
| P. C | 393 | do | 22 | 148 | Do. |
| A. C | 393 | do | 23 | 156 | Do. |
| A. L | 393 | do | 28 | 167 | Do. |

*Daily menu.*

NOVEMBER 17, 1902.

Supper.—Vegetable soup, tripe, biscuit, sugar cookies, cake, butter, tea, sugar, molasses.

NOVEMBER 18.

Breakfast.—Baked beans, tripe, biscuit, beet pickles, sugar cookies, mince pie, tea, coffee, sugar, butter, molasses.

Dinner.—Baked beans, cold roast beef, biscuit, cookies, tea, molasses.

Supper.—Boiled potatoes, beef smother, mashed turnips, biscuit, sugar cake, butter, tea, sugar.

NOVEMBER 19.

Breakfast.—Baked beans, beet pickles, biscuit, butter, molasses cookies, sugar cake, apple sauce, tea, sugar, molasses.

Dinner.—Baked beans, cold corned beef, biscuit, cookies, sugar, tea, molasses.

Supper.—Codfish, boiled potatoes, biscuit, sugar cookies, tea, sugar, apple sauce, butter, molasses.

NOVEMBER 20.

Breakfast.—Baked beans, tripe, biscuit, sugar cookies, apple sauce, tea, coffee, sugar, molasses.

Dinner.—Baked beans, cold roast beef, biscuit, molasses, tea, sugar cookies.

Supper.—Fried steak, boiled potatoes, boiled onions, biscuit, molasses cookies, sugar cake, apple sauce, tea, sugar, molasses.

NOVEMBER 21.

Breakfast.—Baked beans, biscuit, butter, sugar cake, apple sauce, tea, coffee, sugar.

Dinner.—Baked beans, cold beef, biscuit, cookies, tea, molasses.

Supper.—Boiled potatoes, boiled mackerel, tripe, biscuit, butter, sugar cake, tea, sugar.

NOVEMBER 22.

Breakfast.—Baked beans, tripe, biscuit, butter, molasses cookies, sugar cookies, apple sauce, coffee, tea, sugar.

Dinner.—Baked beans, cold corned beef, biscuit, molasses cookies, sugar cookies, tea, molasses.

Supper.—Vegetable soup, biscuit, doughnuts, sugar cake, apple sauce, tea, sugar, butter.

NOVEMBER 23.

Breakfast.—Baked beans, boiled ham, tripe, biscuit, butter, sugar cookies, sugar cake, coffee, tea, condensed milk.

Dinner.—Baked beans, vegetable soup, pickled beets, biscuit, sugar cookies, doughnuts, tea, sugar, butter.

The number of meals taken was as follows:

| Camp crew: | Meals. |
|---|---|
| Breakfasts | 293 |
| Dinners | 293 |
| Suppers | 294 |
| Total number of meals | 880 |

Equivalent to 1 man for 293 days.

TABLE 9.—*Weights and cost of food and nutrients in dietary study No. 393.*

| Food consumed during the entire study (6 days). | | Cost, nutrients, and fuel value of food per man per day. | | | | |
|---|---|---|---|---|---|---|
| Kinds and amounts. | Cost. | Cost. | Protein. | Fat. | Carbohydrates. | Fuel value. |
| ANIMAL FOOD. | *Dols.* | *Cents.* | *Grams.* | *Grams.* | *Grams.* | *Calories.* |
| Beef: Forequarter, 139 pounds, $9.73 (1); corned flank, 89.5 pounds, $6.26 (2); canned corned, 30 pounds, $3 (3); tripe, 8 pounds, 48 cents (4) | 19.47 | 6.6 | 63.3 | 83.0 | 0.3 | 993 |
| Pork: Chuck, salt, 38 pounds, $3.80 (5); smoked shoulder, 19 pounds, $1.81 (7) | 5.61 | 1.9 | 6.0 | 51.5 | .6 | 484 |
| Fish: Cod, 30 pounds, $1.80 (11); mackerel, 27½ pounds, $1.64 (12) | 3.44 | 1.2 | 14.7 | 9.1 | ..... | 139 |
| Dairy products: Butter, 38 pounds, $6.08 (16); condensed milk, 6 pounds, 45 cents (17) | 6.53 | 2.2 | 1.1 | 45.0 | 11.2 | 450 |
| Lard compound, 127 pounds, $11.43 (18) | 11.43 | 3.9 | ..... | 196.4 | ..... | 1,748 |
| Total animal food | 46.48 | 15.8 | 85.1 | 385.0 | 12.1 | 3,814 |

TABLE 9.—*Weights and cost of food and nutrients, etc.*—Continued.

| Food consumed during the entire study (6 days). | | Cost, nutrients, and fuel value of food per man per day. | | | | |
|---|---|---|---|---|---|---|
| Kinds and amounts. | Cost. | Cost. | Protein. | Fat. | Carbohydrates. | Fuel value. |
| VEGETABLE FOOD. | | | | | | |
| Cereals: Wheat flour, 315 pounds, $6.46 (24); rice, 2 pounds, 12 cents (21) | *Dols.* 6.58 | *Cents.* 2.2 | *Grams.* 44.1 | *Grams.* 3.5 | *Grams.* 383.2 | *Calories.* 1,741 |
| Sugars: Sugar, 252 pounds, $12.60 (25); molasses, 20 pounds, 40 cents (27) | 13.00 | 4.4 | .7 | ..... | 411.2 | 1,648 |
| Vegetables: Beans, 76.5 pounds, $3.21 (30); beets, 56 pounds, 56 cents, (30a); cabbage, 46 pounds, 69 cents (31); carrots, 61 pounds, 61 cents (32); onions, 20 pounds, 48 cents (33); peas, 9.5 pounds, 22 cents (34); potatoes, 195 pounds, $2.34 (35); turnips, 86 pounds, 60 cents (36) | 8.71 | 3.0 | 37.8 | 2.5 | 154.1 | 837 |
| Fruit: Evaporated apples, 33 pounds, $2.97 (37) | 2.97 | 1.0 | .8 | 1.1 | 33.8 | 148 |
| Total vegetable food | 31.26 | 10.6 | 83.4 | 7.1 | 982.3 | 4,374 |
| Total food | 77.74 | 26.4 | 168.5 | 392.1 | 994.4 | 8,188 |
| WASTE. | | | | | | |
| Baked beans, 37 pounds | ..... | ..... | 4.4 | 4.3 | 12.4 | 105 |
| FOOD ACTUALLY EATEN. | | | | | | |
| Animal food | ..... | 15.8 | 85.1 | 385.0 | 12.1 | 3,816 |
| Vegetable food | ..... | 10.6 | 79.0 | 2.8 | 969.9 | 4,267 |
| Total food eaten | ..... | 26.4 | 164.1 | 387.8 | 982.0 | 8,083 |

## DIETARY STUDY NO. 394.

The study began with supper January 20, 1903, and continued 8 days. The crew were engaged in drawing logs from the yards to the landing. The list of the men, their occupation, the number of meals eaten, the daily menu, and the weights and costs of foods and nutrients are given in the tables which follow:

TABLE 10.—*Data regarding subjects, dietary study No. 394.*

| Name. | Subject of dietary study Nos.— | Place of birth. | Age. | Weight. | Occupation. |
|---|---|---|---|---|---|
| | | | *Years.* | *Pounds.* | |
| G. M | 394 | Canada | 53 | 147 | Overseer. |
| E. G | 393, 394 | Maine | 22 | 135 | Clerk. |
| E. M | 390, 391, 392, 393, 394 | do | 25 | 149 | Chemist. |
| J. P | 394 | Canada | 63 | 168 | Cook. |
| H. McK | 394 | do | 17 | 126 | Cookee. |
| W. R | 390, 392, 394 | do | 29 | 172 | Do. |
| P. M | 394 | do | 26 | 168 | Blacksmith. |
| F. M | 394 | do | 25 | 150 | Do. |
| N. H | 394 | do | 34 | 183 | Toter. |
| A. C | 394 | do | 25 | 150 | Main road man. |
| J. C | 394 | do | 24 | 142 | Do. |
| A. F | 394 | do | 23 | 162 | Do. |
| O. B | 390, 391, 394 | do | 26 | 183 | Do. |
| E. F | 390, 391, 392, 394 | do | 25 | 175 | Yard man. |
| M. G | 394 | do | 27 | 155 | Do. |
| F. M | 394 | do | 23 | 155 | Do. |
| F. P | 394 | do | 28 | 125 | Do. |
| A. R | 394 | do | 26 | 159 | Do. |
| F. St. P | 394 | do | 24 | 173 | Do. |
| J. C | 390, 391, 394 | do | 56 | 140 | Teamster. |
| J. C | 394 | do | 33 | 143 | Do. |
| P. C | 394 | do | 25 | 148 | Do. |
| J. G | 394 | do | 31 | 168 | Do. |
| R. M | 394 | do | 34 | 142 | Do. |
| D. V | 394 | do | 26 | 148 | Do. |
| P. C | 394 | do | 23 | 148 | Landing man. |
| C. M | 394 | do | 24 | 135 | Do. |
| W. M | 394 | do | 25 | 125 | Do. |
| F. N | 394 | do | 27 | 151 | Do. |
| N. L | 394 | do | 26 | 134 | Do. |
| E. G | 394 | do | 57 | 210 | Scaler. |

*Daily menu.*

JANUARY 20, 1903.

Supper.—Vegetable stew, biscuit, sugar cake, molasses cookies, butter, sugar, sirup, tea.

JANUARY 21.

Breakfast.—Baked beans, cold corned beef, biscuit, sugar cookies, mince pie, butter, sugar, sirup, tea, coffee.

Dinner.—Baked beans, Bologna sausage, biscuit, butter, molasses cookies, tea.

Supper.—Boiled potatoes, boiled codfish, biscuit, butter, molasses cookies, bread pudding, sugar, sirup, tea.

JANUARY 22.

Breakfast.—Baked beans, cold pork, biscuit, butter, sugar cookies, mince pie, coffee, sugar, molasses.

Dinner.—Baked beans, Bologna sausage, cold pork, biscuit, butter, sugar cake, molasses, tea.

Supper.—Boiled potatoes, boiled cabbage, boiled corned beef, biscuit, butter, molasses doughnuts, tea, sugar, molasses.

JANUARY 23.

Breakfast.—Baked beans, biscuit, butter, molasses doughnuts, mince pie, molasses cookies, tea, coffee, sugar, molasses.

Dinner.—Baked beans, Bologna sausage, cold pork, biscuit, butter, sugar cookies, tea, molasses.

Supper.—Boiled potatoes, boiled codfish, biscuit, butter, molasses cookies, bread pudding, tea, sugar, molasses.

JANUARY 24.

Breakfast.—Baked beans, biscuit, butter, sugar cookies, sugar doughnuts, mince pie, tea, coffee, sugar, molasses.

Dinner.—Baked beans, Bologna sausage, cold pork, biscuit, butter, molasses doughnuts, tea, molasses.

Supper.—Roast beef, boiled potatoes, biscuit, butter, sugar cookies, tea, sugar, molasses.

JANUARY 25.

Breakfast.—Baked beans, roast beef, biscuit, butter, sugar cookies, sugar doughnuts, tea, coffee, sugar, molasses.

Dinner.—Baked beans, roast beef, biscuit, butter, sugar doughnuts, sugar cookies, mince pie, tea, sugar, molasses.

Supper.—Roast beef, boiled potatoes, biscuit, butter, molasses cookies, mince pie, tea, sugar, molasses.

JANUARY 26.

Breakfast.—Baked beans, biscuit, butter, sugar cookies, molasses doughnuts, mince pie, tea, coffee, sugar.

Dinner.—Baked beans, Bologna sausage, cold pork (boiled), biscuit, butter, molasses cookies, tea, molasses.

Supper.—Vegetable soup, biscuit, butter, sugar cookies, tea, sugar, molasses.

JANUARY 27.

Breakfast.—Baked beans, corned beef, biscuit, butter, sugar cookies, sugar doughnuts, mince pie, tea, coffee, sugar, molasses.

Dinner.—Baked beans, cold pork (boiled), biscuit, butter, gingerbread, tea, molasses.

Supper.—Boiled corned beef, boiled potatoes, boiled cabbage, biscuit, butter, molasses cookies, tea, sugar, molasses.

JANUARY 28.

Breakfast.—Baked beans, boiled corned beef, biscuit, butter, sugar cookies, mince pie, tea, sugar, molasses.

Dinner.—Baked beans, Bologna sausage, canned corned beef, biscuit, butter, gingerbread, tea, molasses.

The number of meals taken was as follows:

| | Meals. |
|---|---|
| Camp crew: | |
| Breakfasts | 241 |
| Dinners | 239 |
| Suppers | 241 |
| Visitors: | |
| Breakfasts | 8 |
| Dinners | 3 |
| Suppers | 6 |
| Total number of meals | 738 |

Equivalent to 1 man for 246 days.

TABLE 11.—*Weights and cost of food and nutrients in dietary study No. 394.*

| Food consumed during the entire study (8 days). | | Cost, nutrients, and fuel value of food per man per day. | | | | |
|---|---|---|---|---|---|---|
| Kinds and amounts. | Cost. | Cost. | Protein. | Fat. | Carbohydrates. | Fuel value. |
| ANIMAL FOOD. | *Dols.* | *Cents.* | *Grams.* | *Grams.* | *Grams.* | *Calories.* |
| Beef: Forequarter, 167 pounds, $11.69 (1); flank, corned, 50 pounds, $3.50 (2); canned corned, 4 pounds, 40 cents (3) | 15.59 | 6.3 | 58.5 | 81.6 | ..... | 960 |
| Pork: Salt chuck, 62 pounds, $6.20 (5) | 6.20 | 2.5 | 4.8 | 75.7 | 1.2 | 698 |
| Sausage: Bologna, 34 pounds, $3.06 (9) | 3.06 | 1.2 | 8.7 | 6.9 | 2.5 | 106 |
| Fish: Cod, 18 pounds, $1.08 (11) | 1.08 | .4 | 6.3 | .1 | .1 | 26 |
| Dairy products: Butter, 21 pounds, $3.36 (16); condensed milk, 5 pounds, 42 cents (17) | 3.78 | 1.5 | .9 | 29.9 | 9.1 | 306 |
| Lard compound, 64 pounds, $5.76 (18) | 5.76 | 2.3 | ..... | 117.8 | ..... | 1,048 |
| Total animal food | 35.47 | 14.2 | 79.3 | 312.0 | 13.0 | 3,144 |
| VEGETABLE FOOD. | | | | | | |
| Cereals: Wheat flour, 311 pounds, $6.22 (24) | 6.22 | 2.6 | 51.6 | 3.8 | 441.6 | 2,006 |
| Sugars: Sugar, 60 pounds, $3 (25); sirup, 25 pounds, 50 cents (28); molasses, 18 pounds, 36 cents (27) | 3.86 | 1.6 | .8 | ..... | 168.0 | 675 |
| Vegetables: Beans, 68 pounds, $2.86 (30); cabbage, 89 pounds, $1.34 (31); onions, 11 pounds, 26 cents (33); potatoes, 217 pounds, $2.60 (35) | 7.06 | 3.0 | 35.4 | 2.4 | 145.9 | 796 |
| Fruit: Apples, dried, 12 pounds, $1.08 (37); raisins, 11 pounds, 80 cents (40); strawberry jelly, 12 pounds, 72 cents (42) | 2.60 | 1.1 | .9 | 1.1 | 46.8 | 201 |
| Total vegetable food | 19.74 | 8.3 | 88.7 | 7.3 | 802.3 | 3,678 |
| MISCELLANEOUS FOOD. | | | | | | |
| Mince-meat, 32 pounds, $3.20 (43) | 3.20 | 1.3 | 3.9 | .8 | 35.5 | 164 |
| Total food | 55.21 | 23.8 | 171.9 | 320.1 | 850.8 | 6,986 |
| WASTE. | | | | | | |
| Baked beans, 25 pounds | ..... | ..... | 3.7 | 3.5 | 10.0 | 86 |
| Cabbage, 6 pounds | ..... | ..... | .2 | .5 | .8 | 8 |
| Pudding, 6 pounds | ..... | ..... | .4 | .5 | .8 | 9 |
| Total waste | ..... | ..... | 4.3 | 4.5 | 11.6 | 103 |
| FOOD ACTUALLY EATEN. | | | | | | |
| Animal food | ..... | 14.9 | 83.2 | 312.8 | 13.0 | 3,168 |
| Vegetable food | ..... | 8.9 | 84.4 | 2.8 | 826.2 | 3,715 |
| Total food eaten | ..... | 23.8 | 167.6 | 315.6 | 839.4 | 6,883 |

## DISCUSSION OF THE DIETARIES.

The following table summarizes the results of dietary studies with Maine lumbermen. For purposes of comparison it also includes the results of a number of studies with German lumbermen, Russian and American workingmen engaged in severe labor, and athletes, as well as the commonly accepted American dietary standards.

TABLE 12.—*Summary of results of dietary studies of Maine lumbermen and others at severe work—Quantities per day.*

| Persons or groups. | Cost. | Protein. | Fat. | Carbohydrates. | Fuel value. |
|---|---|---|---|---|---|
| Maine lumbermen: | | | | | |
| Chopping and yarding— | *Cents.* | *Grams.* | *Grams.* | *Grams.* | *Calories.* |
| Dietary No. 390 | 28.6 | 247 | 386 | 944 | 8,199 |
| Dietary No. 393 | 26.4 | 164 | 388 | 982 | 8,085 |
| Average | 27.5 | 206 | 387 | 963 | 8,140 |
| Drawing logs to landing— | | | | | |
| Dietary No. 391 | 23.6 | 179 | 336 | 769 | 6,782 |
| Dietary No. 394 | 23.8 | 168 | 316 | 839 | 6,836 |
| Average | 23.7 | 173 | 326 | 804 | 6,888 |
| River driving, dietary No. 392 | 15.1 | 152 | 261 | 526 | 5,035 |
| Average of above dietary studies with Maine lumbermen | 23.5 | 182 | 337 | 812 | 6,995 |
| Bavarian lumbermen at severe work: | | | | | |
| Jachenau, Tölz[a] | ..... | 144 | 358 | 606 | 6,186 |
| Reichenhall Mountains[a] | ..... | 112 | 309 | 691 | 5,962 |
| Oberandorfer Mountains[a] | ..... | 135 | 208 | 876 | 5,895 |
| Average | ..... | 130 | 292 | 724 | 6,015 |
| Bavarian farm laborers at severe work: | | | | | |
| Average of three dietaries | ..... | 137 | 202 | 546 | 4,330 |
| Russians at severe work:[a] | | | | | |
| Sawyers, Astrakhan[b] | ..... | 211 | 93 | 868 | 5,283 |
| Mowers, Astrakhan[b] | ..... | 216 | 153 | 537 | 4,651 |
| Carpenters, Astrakhan[b] | ..... | 144 | 73 | 693 | 4,108 |
| Workmen and laborers, Cronstadt Dock— | | | | | |
| Food costing $3.85 per month[c] | ..... | 123 | 43 | 563 | 3,207 |
| Food costing $5.78 per month[c] | ..... | 122 | 52 | 419 | 2,704 |
| Food costing $10.40 per month[c] | ..... | 146 | 140 | 460 | 3,785 |
| Laborers, Cronstadt Dock— | | | | | |
| Ordinary diet[d] | ..... | 220 | 95 | 931 | 5,603 |
| Diet during Lent or other church fasts[d] | ..... | 216 | 95 | 1,040 | 6,033 |
| Miners, Tomsk— | | | | | |
| Minimum diet[e] | ..... | 248 | 55 | 965 | 5,482 |
| Maximum diet[e] | ..... | 281 | 66 | 1,075 | 6,174 |
| New England men at severe work: | | | | | |
| Teamsters and marble workers | ..... | 254 | 363 | 826 | 7,551 |
| Brickmakers | ..... | 180 | 365 | 1,150 | 8,569 |
| Athletes: | | | | | |
| Football teams | ..... | 226 | 354 | 634 | 6,590 |
| Rowing clubs | ..... | 155 | 177 | 440 | 3,955 |
| Bicyclists | ..... | 186 | 186 | 651 | 5,003 |
| French Canadians: | | | | | |
| Brickmakers, Massachusetts | ..... | 109 | 185 | 603 | 4,495 |
| Factory operatives, Massachusetts | ..... | 123 | 209 | 529 | 4,468 |
| Laborers, Canada | ..... | 108 | 106 | 526 | 3,479 |
| Dietary standards (Atwater): | | | | | |
| Man with very hard muscular work | ..... | 175 | (*f*) | (*f*) | 5,500 |
| Man with hard muscular work | ..... | 150 | (*f*) | (*f*) | 4,150 |
| Man with moderately active muscular work | ..... | 125 | (*f*) | (*f*) | 3,400 |
| Man with light to moderate muscular work | ..... | 112 | (*f*) | (*f*) | 3,050 |
| Man at "sedentary" or woman with moderately active work | ..... | 100 | (*f*) | (*f*) | 2,700 |

[a] U. S. Dept. Agr., Office of Experiment Stations Bul. 21, p. 191. Quoted from Höfler (Jachenau), and Liebig.

[b] Soudakov, quoted by P. Smolensky, Traité Hygiène, Paris, 1904, p. 14.

[c] Tichkov, quoted by P. Smolensky, Traité Hygiène, Paris, 1904, p. 15.

[d] Ivanov, quoted by P. Smolensky, Traité Hygiène, Paris, 1904, p. 15.

[e] Réoutovsky, quoted by P. Smolensky, Traité Hygiène, Paris, 1904, p. 15.

[f] Fats and carbohydrates in sufficient amounts to furnish, together with the protein, the indicated amount of energy.

In each of the two years included in the investigation the largest amount of total food was eaten per man per day while the men were at the hard and continuous work of felling and trimming trees and swamping roads. In yarding logs the hauls were short and the men got no respite from work. In the first study (No. 390) the amount of protein eaten was very much larger than in any of the others and may have been excessive. There is nothing in the recorded data to explain this. The meats did not differ in kind, quality, or variety from those used in the similar dietary (No. 393) made the second year. The total protein in the food eaten in dietary No. 393 was very nearly the same as in the studies made when the men were at work drawing logs to the landing. Very likely the protein in dietary No. 390 may be above or that in dietary No. 393 may be below a normal amount for these men. Possibly the average more nearly represents the usual amount of protein contained in the food while the men are at work chopping and yarding than either of the studies alone. The needs of the body resulting from the severe character of this kind of labor are perhaps better indicated by the high fuel value (8,140 calories per man per day) of the food consumed, and this factor agrees quite closely in the two studies. The fat is practically the same in the two dietaries. Quite a little more of the total energy of the food came from the carbohydrates and less from the protein in dietary No. 393 than in dietary No. 390.

There is very close agreement, which is doubtless more or less accidental, in the quantities of nutrients and energy in studies Nos. 391 and 394, made in different years while the men were drawing logs to the landing. The food eaten in these two studies furnished on an average one-sixth less protein and one-sixth less energy than in the average of the two studies (Nos. 390 and 393) while chopping and yarding. The smaller quantity of food eaten in studies Nos. 391 and 394 was very likely due in part to differences in amount and character of work done. The work of loading and unloading logs is less continuous than that of felling and trimming trees and swamping roads, and the teamsters do not work nearly so hard on the comparatively long haul to the landing as on the short hauls when yarding. There would therefore be less bodily demand for food at such times. On the other hand, it may be that the food supplied in studies Nos. 390 and 393 was better than that to which the men had been accustomed before going into camp, and, as they had then been in the woods a comparatively short time, it would be natural that in such a case they would eat more than after having had this kind of diet for several weeks. In other words, even if the amount of work had been the same in studies Nos. 391 and 394 as in Nos. 390 and 393, the amount of food eaten might still have been less, because at the later period the diet would seem less appetizing to the men who had been eating it for a considerable length of time.

It is natural to suppose that the men who worked on the drives, wet with the icy water of early spring and eating four and sometimes five meals a day, would consume more food than any other class of lumber workers, but while making the preliminary arrangements for the experiments it was learned from the operators that in their opinion this was not the case. They stated that it took 25 per cent more food and cost nearly twice as much to feed the men while at work in the woods, particularly early in the season, as it did when upon the drives. In spite of this the comparatively small amounts of nutrients and energy supplied by the food eaten while the men were on the drive seem surprising, the protein and the energy of the diet in this case (dietary No. 392) being one-fourth less than when the crew was at work chopping. The articles included in the daily menus help to explain this. In dietaries Nos. 390, 391, 393, and 394 there was a considerable variety in the food, as great, in fact, as has been noted in studies with a considerable number of men in comparable circumstances who lived closer to markets; but when driving logs the men were compelled to eat alone, wherever the cookee chanced to find them, and their four or five meals per day were made up invariably of beans, biscuits, cookies, tea, and molasses. These conditions might naturally tend to lessen the appetite. This study (No. 392) was made when the lumber crew had just begun driving logs—that is, immediately after they had been living upon a more abundant diet. As may be seen by reference to the data in the tables regarding the weights of the men at the beginning of the several dietary studies (pp. 16, 18, 22, 25, and 27), this change was accompanied by a loss of weight in the case of the men in dietary No. 392, who were engaged in severe work (driving logs), as compared with their weights in earlier studies. There were nine such men (T. H., M. B., J. D., E. F., J. H., J. P., A. F., A. R., and E. T.), and in all cases except one loss of weight was observed, ranging from 1 to 9 pounds and being on an average 6 pounds. In the case of the ninth man (E. T.) there was a small gain, namely, 1 pound.

By reference to Table 12 it may be seen that the amount of protein in the dietary of the Maine lumbermen when chopping and yarding considerably exceeded the amount called for by the commonly accepted American dietary standard for men at very hard muscular work. In the case of men drawing logs to the landing it was practically equal to the amount called for by this standard, and in the case of the men engaged in river driving it was considerably less, being practically the amount called for by the standard for men with hard muscular work. Considering the average of all the studies, the amount of protein was only 12 grams in excess of the standard for men at very hard muscular work. As regards energy, the average amount furnished by the dietaries of men engaged in chopping and yarding and in drawing logs to the landing was far in excess of the

amounts called for by the standard for very hard muscular work. When engaged in driving logs on the river the amount of energy observed (5,035 calories) was less than that demanded by this standard, namely, 5,500 calories. In the average of all five studies the amount of energy per man per day was almost 1,500 calories above the standard mentioned.

It seems fair to say, therefore, that judged by the best available data the diet of the Maine lumbermen appeared to be sufficient as regards both protein and energy. That it was not excessive, however, was indicated by the fact that the men did not gain markedly in weight, and certainly if it may be assumed that the appetite is a guide to the amount of food required the men did not eat more than they needed. The exposure to wet and cold may have been one of the causes for the consumption of large amounts of food. The idea is often advanced that men are more resistant to disease when they live at a high protein level. If this view is correct the large amount of protein observed was perhaps an advantage, and it is at least possible that the dietary which is typical of Maine lumber camps in general has been adopted because experience has shown that it is suited to the conditions under which the men live and work. The general health of the men in the studies recorded remained good, notwithstanding the severe work and exposure. Of course the vigorous out-of-door life in the pure air of the Maine woods was a factor favorable to health.

The only other studies of lumbermen's dietaries so far as the writers know are those made in the Bavarian Mountain regions by Liebig and by Hoefler. The dietary of the peasant in the region where these studies and dietaries, which are summarized in Table 12, were made is discussed by Ranke[a] in effect as follows:

In contrast to the conditions prevalent elsewhere in Germany, the food of the country people in the Bavarian highlands and mountains is very simple, and although potatoes have not become the principal food material there the food is chiefly vegetable. The famous peasant of the Bavarian Mountain region, the genuine "Haberfeldtreiber," as he proudly calls himself, eats meat, in accordance with the time-honored usage, only on the four great holidays of the year. He lives upon "Schmalzkost," that is to say, simple preparations of flour, with which large quantities of fat are incorporated. To these he adds such materials as sauerkraut and dried apples or peas. The food of these powerful peasants is so generous in amount as to explain their herculean development of muscle, their enviable vigor, and their consciousness of strength, which often leads to excess. It is likewise a current observation by people in the Tegernsee Mountains that the larger their appetites the more work the lumbermen can do.

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[a] Quoted in U. S. Dept. Agr., Office of Experiment Stations Bul. 21, p. 190.

By reference to Table 12 it will be seen that as regards both protein and energy the dietary of the Maine lumbermen on an average exceeded that of the Bavarians.

As regards the protein, the Maine lumbermen received in general somewhat smaller amounts than the Russian laborers at severe work, but the amounts of energy in their dietaries were larger. The amounts of fat in the Russian dietaries were notably small. The foods eaten by the Russian laborers differ much in character from those commonly used in America, and therefore a more detailed comparison would hardly be warranted, as the digestibility of the foods is a matter which should always be taken into account.

With the exception of one study with a football team the dietaries of the New England men at severe work quoted in Table 12 are the largest hitherto reported in connection with the series of nutrition investigations of which the present studies are a part, though it should be pointed out that these were compiled from statistics of food purchased as shown by the books of the boarding-house keepers, and are therefore only approximations, whereas the dietaries of the football teams, bicyclists, and rowing clubs were carefully made and, like those of the lumbermen here reported, show the nutrients and fuel value of the food actually eaten. The dietaries of the Maine lumbermen on an average exceeded the dietaries of athletes very considerably as regards energy. In the case of protein the average amount is smaller than was observed with the football teams, but greater than in the case of the rowing clubs.

As most of the men in the Maine lumbermen dietaries were French Canadians, the results of some other dietary studies of men of this nationality are given. The large size of these dietaries of men at work in the Maine woods as compared with the results of other studies of French Canadians is striking.

## THE COST OF THE FOOD.

In the dietaries of the Maine lumbermen the cost of food ranged from 15.1 cents per person per day in the case of the men driving logs on the river to 28.6 cents in the case of one of the studies made with men who were chopping and yarding. On an average the total cost was 23.5 cents. The sum expended for animal food ranged from 10.6 cents in the case of dietary No. 392 (river driving) to 18.1 cents in the case of dietary No. 390 (chopping and yarding). The amount expended for vegetable food ranged from 4.5 cents with dietary No. 392 to 10.6 cents with dietary No. 393 (chopping and yarding). It will be seen that on an average about two-thirds of the total expenditure was for animal food and about one-third for vegetable food. The proportion of the total cost that was expended for different articles of diet in these studies is shown in the following table:

TABLE 13.—*The comparative cost of foods per man per day in dietary studies in Maine lumber camps.*

| Kind of food. | Dietary No. 390. | Dietary No. 393. | Average Nos. 390 and 393. | Dietary No. 391. | Dietary No. 394. | Average Nos. 391 and 394. | Dietary No. 392. |
|---|---|---|---|---|---|---|---|
| | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* |
| Beef | 14.3 | 25.0 | 19.7 | 29.2 | 28.0 | 28.6 | 17.2 |
| Pork | 20.6 | 7.2 | 13.9 | 7.2 | 11.1 | 9.2 | 23.2 |
| Sausage | 3.4 | ---------- | 1.7 | 3.8 | 5.3 | 4.5 | 6.0 |
| Fish | 12.9 | 4.5 | 8.7 | 6.4 | 1.8 | 4.1 | 9.3 |
| Dairy products | 4.9 | 8.3 | 6.6 | 16.4 | 6.7 | 6.6 | 4.0 |
| Lard | 7.2 | 14.8 | 11.0 | 11.0 | 10.2 | 10.6 | 10.5 |
| Total animal food | 63.3 | 59.8 | 61.6 | 64.0 | 63.1 | 63.6 | 70.2 |
| Cereals | 8.7 | 8.3 | 8.5 | 8.1 | 11.6 | 9.8 | 11.9 |
| Sugars | 4.2 | 16.7 | 10.4 | 8.5 | 7.1 | 7.8 | 2.0 |
| Vegetables | 16.1 | 11.4 | 13.8 | 10.5 | 12.3 | 11.9 | 15.3 |
| Fruits | 7.7 | 3.8 | 5.7 | 8.9 | 4.9 | 6.9 | .6 |
| Total vegetable food | 36.7 | 40.2 | 38.4 | 36.0 | 36.9 | 36.4 | 29.8 |
| Total food | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

## AMOUNT OF FOOD WASTED.

The food wasted in these dietary studies was very small in amount, being limited to the portions left uneaten on the plates. The total waste equaled only about 3 per cent of the protein and 2 per cent of the energy of the total food supplied.

## SOURCES OF PROTEIN AND ENERGY.

The tables which follow show the percentages of the total protein and energy supplied by the more important foods and by the total animal and total vegetable foods:

TABLE 14.—*Sources of protein in dietary studies in Maine lumber camps.*

| Kind of food. | Dietary No. 390. | Dietary No. 393. | Average Nos. 390 and 393. | Dietary No. 391. | Dietary No. 394. | Average Nos. 391 and 394. | Dietary No. 392. |
|---|---|---|---|---|---|---|---|
| | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* |
| Beef | 13.6 | 37.7 | 25.7 | 33.2 | 34.9 | 34.1 | 14.2 |
| Pork | 10.5 | 3.6 | 7.0 | 2.9 | 2.9 | 2.9 | 7.4 |
| Sausage | 2.4 | ---------- | 1.2 | 2.6 | 5.2 | 3.9 | ---------- |
| Fish | 17.3 | 7.9 | 12.6 | 9.9 | 3.2 | 6.5 | 8.5 |
| Dairy products | .1 | .6 | .4 | ---------- | .5 | .3 | [a]4.1 |
| Lard | ---------- | ---------- | ---------- | ---------- | ---------- | ---------- | ---------- |
| Total animal food | 43.9 | 49.8 | 46.9 | 48.6 | 46.7 | 47.7 | 34.2 |
| Cereals | 23.3 | 26.9 | 25.0 | 21.9 | 31.1 | 26.5 | 30.4 |
| Sugars | ---------- | .4 | .2 | ---------- | .5 | .2 | ---------- |
| Vegetables | 32.2 | 22.4 | 27.3 | 28.5 | 21.2 | 24.9 | 35.4 |
| Fruits | .7 | .5 | .6 | 1.0 | .5 | .7 | ---------- |
| Total vegetable food | 56.1 | 50.2 | 53.1 | 51.4 | 53.3 | 52.3 | 65.8 |
| Total food | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

[a] From eggs.

TABLE 15.—*Sources of energy in dietary studies in Maine lumber camps.*

| Kind of food. | Dietary No. 390. | Dietary No. 393. | Average Nos. 390 and 393. | Dietary No. 391. | Dietary No. 394. | Average Nos. 391 and 394. | Dietary No. 392. |
|---|---|---|---|---|---|---|---|
| | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* |
| Beef | 8.2 | 12.3 | 10.3 | 16.6 | 14.3 | 15.4 | 10.5 |
| Pork | 16.6 | 6.0 | 11.3 | 6.9 | 10.4 | 8.6 | 19.7 |
| Sausage | 1.0 | ---------- | .5 | 2.1 | 1.6 | 1.9 | 1.0 |
| Fish | 5.9 | 1.7 | 3.8 | 2.3 | .3 | 1.3 | 1.3 |
| Dairy products | 3.5 | 5.6 | 4.5 | 4.8 | 4.6 | 4.7 | [a]2.7 |
| Lard | 11.4 | 21.6 | 16.5 | 16.9 | 15.6 | 16.3 | 14.5 |
| Total animal food | 46.6 | 47.2 | 46.9 | 49.6 | 46.8 | 48.2 | 49.7 |
| Cereals | 23.5 | 21.3 | 22.4 | 19.0 | 29.4 | 24.4 | 28.7 |
| Sugars | 7.6 | 20.1 | 13.9 | 13.6 | 9.9 | 11.8 | 3.9 |
| Vegetables | 17.4 | 9.6 | 13.5 | 12.4 | 10.9 | 11.6 | 17.1 |
| Fruits | 4.9 | 1.8 | 3.3 | 5.4 | 3.0 | 4.2 | .6 |
| Total vegetable food | 53.4 | 52.8 | 53.1 | 50.4 | 53.2 | 51.8 | 50.3 |
| Total food | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

[a] From eggs.

While the men were at the camp chopping, yarding, and drawing the logs to the landing, the protein was obtained about equally from the animal and vegetable foods. When driving logs their diet was made up quite largely of beans, and only one-third of the protein was supplied by animal food. As regards energy, about half the total amount was supplied by animal foods and half by vegetable foods in all the studies, beef, pork, and lard being the most important animal foods in this respect and cereals and vegetables the most important vegetable foods.

## DIGESTION EXPERIMENTS WITH MAINE LUMBERMEN ON A MIXED DIET.

In order to learn how completely the very large amount of food eaten by the lumbermen was assimilated, two series of digestion experiments were planned and carried out in the winter of 1902–3. In these studies the men had the same food as their companions who were in dietary studies Nos. 393 and 394, reported on pages 24 to 30 of this bulletin. They were not restricted in their food, and ate from the same mixed diet, in the same room, and at the same time as the rest of the crew. Three of the six experiments reported were made while the crew was engaged in the hard work of cutting and yarding the logs, and the remaining three while they were drawing the logs from the yards to the landing. The subjects were selected as being typical of the camp in vigor, in the amount of food they ate, and in their capacity for work. Each experiment began at noon and lasted six days. With the camp conveniences it was impracticable to use a marker and make a separation of the feces in the usual manner, but as the food eaten during the experiments was of the same character as that the subjects were eating before and after the experimental period, the feces for the six days following the one on which the experiment began were collected and were assumed to represent the undigested residues from the food eaten. Because of the uni-

formity of the diet, the regularity of the men in stooling, and the long duration of the experiment, it is believed that no serious error was thus introduced. The close agreement of the experiments also confirms the belief.

It was impracticable to collect the urine voided in these experiments, and therefore the balance of income and outgo of nitrogen was not ascertained.

## COMPOSITION OF FOOD MATERIALS AND FECES.

All of the food materials were sampled at the time of use. Usually the same kind of food was used at several meals, and in such cases a composite sample was made for analysis. The samples were kept frozen in suitable jars and brought to the laboratory of the Maine Experiment Station, where they were dried, subsampled, and analyzed by the usual methods. The feces were deposited in large museum jars, and kept frozen until brought to the station for analysis. The heats of combustion of all of the foods and of the feces were determined by the usual method with the bomb calorimeter. The results of the analyses of the foods are included in Table 16 and of the feces in Table 17. In the case of the feces the analyses are reported on a water-free basis, as the amount of water in feces is not important in computing the results of digestion experiments.

TABLE 16.—*Composition of food materials in digestion experiments with Maine lumbermen.*

| Laboratory No. | Kind of food. | Water. | Nitrogen. | Protein. | Fat. | Carbohydrates. | Ash. | Heat of combustion per gram. |
|---|---|---|---|---|---|---|---|---|
| | | *Per ct.* | *Per ct.* | *Per ct.* | *Per ct.* | *Per ct.* | *Per ct.* | *Calories.* |
| 6743 | Beef smother | 65.08 | 2.22 | 13.89 | 14.74 | 3.82 | 3.47 | 2.284 |
| 6744 | Corned beef, boiled | 43.06 | 4.33 | 27.08 | 22.55 | 1.06 | 6.15 | 3.784 |
| 6745 | Corned beef, canned | 56.75 | 4.39 | 27.41 | 10.38 | .74 | 4.72 | 2.509 |
| 6783 | Corned beef, boiled | 37.96 | 1.61 | 10.05 | 38.57 | 9.84 | 3.59 | 4.452 |
| 6784 | Roast beef | 58.03 | 5.19 | 32.45 | 8.07 | ---------- | 1.83 | 2.089 |
| 6746 | Pork chuck, salt | 22.44 | .67 | 4.16 | 66.26 | 1.02 | 6.12 | 6.124 |
| 6747 | Bologna sausage | 68.30 | 2.73 | 17.05 | 7.47 | 3.99 | 3.19 | 1.835 |
| 6786 | do | 66.16 | 2.30 | 14.40 | 11.31 | 4.04 | 4.09 | 2.039 |
| 6750 | Codfish | 54.05 | 4.90 | 30.59 | 6.67 | .30 | 8.39 | 2.338 |
| 6751 | Codfish hash | 75.30 | .74 | 4.63 | 3.21 | 15.19 | 1.67 | 1.172 |
| 6752 | Butter | 8.75 | .06 | .38 | 75.23 | 10.24 | 5.40 | 7.233 |
| 6754 | Biscuit, sour dough | 37.74 | .98 | 6.12 | 8.06 | 47.71 | .37 | 3.088 |
| 6791 | do | 34.50 | 1.06 | 6.62 | 6.83 | 51.53 | .52 | 3.196 |
| 6755 | Sugar cake | 26.13 | .54 | 3.37 | 5.76 | 63.60 | 1.14 | 3.328 |
| 6756 | Gingerbread | 22.37 | .94 | 5.86 | 6.47 | 63.60 | 1.70 | 3.525 |
| 6795 | do | 21.14 | .95 | 5.91 | 8.46 | 62.60 | 1.89 | 3.720 |
| 6757 | Molasses cookies | 18.08 | .95 | 5.93 | 9.69 | 64.66 | 1.64 | 3.790 |
| 6794 | do | 19.30 | .87 | 5.43 | 10.14 | 62.82 | 2.31 | 3.864 |
| 6758 | Sugar cookies | 21.85 | .91 | 5.69 | 7.78 | 64.38 | .30 | 3.710 |
| 6792 | do | 16.03 | .91 | 5.68 | 11.65 | 65.94 | .70 | 3.716 |
| 6759 | Sugar doughnuts | 14.98 | .97 | 6.04 | 19.96 | 58.12 | .90 | 4.533 |
| 6793 | do | 14.70 | .74 | 4.61 | 27.04 | 53.21 | .44 | 4.846 |
| 6796 | Molasses doughnuts | 18.49 | .76 | 4.73 | 19.77 | 55.96 | 1.05 | 4.478 |
| 6761 | Baked beans | 61.37 | 1.26 | 7.88 | 5.74 | 22.35 | 2.66 | 1.887 |
| 6787 | do | 59.63 | 1.29 | 8.09 | 7.52 | 21.64 | 3.12 | 2.055 |
| 6762 | Cabbage, boiled | 87.96 | .22 | 1.35 | .88 | 7.72 | 2.09 | .480 |
| 6788 | do | 84.68 | .25 | 1.54 | 4.13 | 6.98 | 2.67 | .733 |
| 6763 | Potatoes, boiled | 73.85 | ---------- | 1.66 | .03 | 23.69 | .77 | 1.060 |
| 6789 | do | 76.07 | .30 | 1.90 | .03 | 21.22 | .78 | .978 |
| 6764 | Potato soup | 76.92 | ---------- | 5.01 | 4.48 | 11.60 | 1.99 | 1.174 |
| 6790 | Vegetable soup | 84.62 | .57 | 3.59 | 2.35 | 8.06 | 1.38 | .756 |
| 6799 | Mince pie | 42.72 | ---------- | 4.17 | 8.14 | 44.02 | .95 | 2.791 |
| 6798 | do | 36.57 | .76 | 4.74 | 11.34 | 46.68 | .67 | 3.189 |
| 6797 | Bread pudding | 36.32 | .51 | 3.21 | 4.36 | 54.33 | 1.78 | 2.853 |
| 6724 | Strawberry jelly | 17.00 | ---------- | ---------- | -------- | 83.00 | -------- | 3.403 |
| 6803 | Molasses | 26.49 | ---------- | 2.33 | -------- | 68.00 | 3.16 | 2.759 |
| ------ | Sugar | -------- | ---------- | ---------- | -------- | 100.00 | -------- | 3.959 |

TABLE 17.—*Composition of water-free feces in digestion experiments with Maine lumbermen.*

| Laboratory No. | Feces. | Protein. | Fat. | Carbohydrates. | Ash. | Heat of combustion per gram. |
|---|---|---|---|---|---|---|
| | | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* | *Calories.* |
| 6765 | Experiment No. 463 | 48.33 | 12.04 | 28.05 | 11.58 | 5.257 |
| 6766 | Experiment No. 464 | 48.59 | 11.17 | 30.54 | 9.70 | 5.351 |
| 6767 | Experiment No. 465 | 45.98 | 7.56 | 38.02 | 8.44 | 5.267 |
| 6800 | Experiment No. 466 | 52.77 | 9.52 | 28.39 | 9.32 | 5.502 |
| 6801 | Experiment No. 467 | 49.18 | 10.47 | 29.64 | 10.71 | 5.284 |
| 6802 | Experiment No. 468 | 51.16 | 10.10 | 29.07 | 9.67 | 5.382 |

## DETAILS OF DIGESTION EXPERIMENTS.

The details of the digestion experiments are included in Tables 18–23. These show the kinds and amounts of food eaten by the subject. The quantities in the column "total organic matter" are the sums of the quantities in the three following columns, "protein," "fat," and "carbohydrates." The amounts of protein, fat, and carbohydrates in each food material and in the feces were computed from the weight of each material multiplied by its percentage composition and heat of combustion, as shown in Table 16. For convenience the same reference numbers for the food materials and feces are used in the tables of composition and in the tables giving the weights of nutrients in the foods. The differences between the total nitrogen of the food eaten and that rejected in the feces are taken as a measure of the total amount digested. The feces, however, do not consist solely of undigested residue, but contain a large amount of metabolic products. The amount of metabolic nitrogen in the feces, as found by two different methods, is given in Table 24 and discussed on page 55. The amounts of nutrients rejected in the feces, while not strictly representing the undigested parts of the food, do represent approximately the amounts which were not available to the body. The point has been discussed at length by Atwater.[a] The total amount of any particular kind of nutrient digested divided by the total amount of this nutrient in the food gives the percentage which is digestible or actually available to the body. These percentage values are called coefficients of digestibility. These coefficients are given in the last line of each of the tables showing the details of the digestion experiments and are summarized in the table on page 52.

While the coefficients of digestibility of the different nutrients represent the proportion which the body actually utilizes, the corresponding value for the heat of combustion of the food does not represent the actual amount of energy which the body obtains from the food absorbed from the alimentary canal. When protein is burned in the bomb calorimeter the carbon is oxidized to carbon dioxid and the hydrogen to water. The nitrogen is left in the free state. When protein is burned in the

[a] Connecticut Storrs Station Rpts. 1896 and 1897.

body, however, the oxidation is not so complete. The nitrogen is excreted in the urine largely in the form of urea, but with some uric acid and other allied compounds which also contain small amounts of carbon and hydrogen together with some oxygen. In estimating the actual fuel values of the digestible nutrients, allowance must be made for these incompletely oxidized residual products which are excreted by the kidneys. Urea is the most abundant of these products, and in lack of determinations of the actual heats of combustion of these incompletely oxidized products, estimates have sometimes been made on the assumption that all of the nitrogen excreted in the urine is thus combined, and allowance has been made for the heat of combustion of the amount of urea corresponding to the amount of nitrogen found in the urine or in the digestible protein in the food consumed. On this supposition 0.87 calorie of the energy latent in each gram of digestible protein would be lost to the body in the urea corresponding to the nitrogen of such protein. In a considerable number of actual determinations of the ratio of the nitrogen to heat of combustion in urine of healthy men, the average heat of combustion of the organic matter in the urine corresponding to 1 gram of digestible protein was found to be considerably greater than 0.87 calorie, and in the digestion work of the nutrition investigations of this Office it has been decided to use for the present, and until a more accurate factor has been ascertained, the factor 1.25 calories as more nearly corresponding to the energy of the urine for a gram of digestible protein. The figures given in the tables for the proportion of energy actually available to the body in the food eaten were obtained, therefore, by deducting from the total energy of the digested food the energy lost to the body in organic matter of the urine as determined by multiplying the total amount of digestible protein by 1.25.

### Digestion Experiment No. 463.

*Kind and amounts of food.*—A mixed diet with large amounts of baked beans, corned beef, biscuits, etc.

*Subject.*—A. F.

*Age.*—Twenty-three years.

*Weight (with clothing).*—At the beginning of the experiment, 162 pounds.

*Duration.*—Six days, with 18 meals, beginning with dinner December 3, 1902.

The daily menu, as well as the amounts of the individual foods eaten at each meal, was as follows:

*Daily menu and amounts eaten at each meal.*

DECEMBER 3.

Dinner.—Baked beans, 400 grams; canned corned beef, 76 grams; biscuit, 300 grams; sugar, 13.4 grams; butter, 27.2 grams.

Supper.—Vegetable soup, 720 grams; biscuit, 150 grams; butter, 27.2 grams; sugar, 13.4 grams.

DECEMBER 4.

Breakfast.—Baked beans, 150 grams; biscuit, 225 grams; sugar cookies, 38 grams; butter, 20.4 grams; sugar, 13.4 grams.

Dinner.—Baked beans, 268 grams; canned corned beef, 70 grams; biscuit, 375 grams; sugar cookies, 47 grams; butter, 34 grams; sugar, 13.4 grams.

Supper.—Boiled corned beef, 148 grams; boiled cabbage, 541 grams; boiled potatoes, 160 grams; biscuit, 300 grams; butter, 13.6 grams; sugar, 13.4 grams.

DECEMBER 5.

Breakfast.—Baked beans, 215 grams; biscuit, 220 grams; sugar cake, 35 grams; butter, 20.4 grams; sugar, 13.4 grams.

Dinner.—Baked beans, 370 grams; canned corned beef, 20 grams; biscuit, 300 grams; sugar cake, 53 grams; butter, 27.2 grams; sugar, 13.4 grams.

Supper.—Boiled codfish, 244 grams; boiled potatoes, 262 grams; pork chuck, 81 grams; biscuit, 240 grams; butter, 20.4 grams; sugar, 13.4 grams.

DECEMBER 6.

Breakfast.—Baked beans, 175 grams; biscuit, 225 grams; molasses cookies, 55 grams; butter, 20.4 grams; sugar, 13.4 grams.

Dinner.—Baked beans, 385 grams; biscuit, 240 grams; butter, 20.4 grams; sugar, 13.4 grams.

Supper.—Codfish hash, 503 grams; pork chuck, 11 grams; biscuit, 400 grams; butter, 34 grams; sugar, 13.4 grams.

DECEMBER 7.

Breakfast.—Baked beans, 194 grams; biscuit, 225 grams; butter, 20.4 grams; sugar, 13.4 grams.

Dinner.—Baked beans, 224 grams; canned corned beef, 121 grams; biscuit, 225 grams; sugar cookies, 150 grams; mince pie, 405 grams; butter, 20.4 grams; sugar, 13.4 grams.

Supper.—Vegetable soup, 570 grams; biscuit, 400 grams; butter, 34 grams; sugar, 13.4 grams.

DECEMBER 8.

Breakfast.—Baked beans, 154 grams; biscuit, 75 grams; mince pie, 278 grams; butter, 6.8 grams; sugar, 13.4 grams.

Dinner.—Baked beans, 276 grams; Bologna sausage, 147 grams; biscuit, 300 grams; gingerbread, 94 grams; butter, 25.2 grams; sugar, 13.4 grams.

Supper.—Beef smother, 735 grams; boiled potatoes, 82 grams; biscuit, 375 grams; butter, 31.5 grams; sugar, 13.4 grams.

DECEMBER 9.

Breakfast.—Baked beans, 172 grams; biscuit, 225 grams; mince pie, 155 grams; butter, 18.9 grams; sugar, 13.4 grams.

TABLE 18.—*Results of digestion experiment No. 463.*

| Laboratory No. | Kind of food. | Weight of materials. | Total organic matter. | Protein (N×6.25). | Fat. | Carbohydrates. | Ash. | Energy. |
|---|---|---|---|---|---|---|---|---|
| | | *Grams.* | *Grams.* | *Grams.* | *Grams.* | *Grams.* | *Grams.* | *Calories.* |
| 6743 | Beef smother | 735.0 | 238.50 | 102.10 | 108.30 | 28.1 | 18.20 | 1,679.00 |
| 6744 | Corned beef, boiled | 224.0 | 113.80 | 60.70 | 50.70 | 2.4 | 13.80 | 847.60 |
| 6745 | Corned beef, canned | 287.0 | 110.60 | 78.70 | 29.80 | 2.1 | 13.50 | 720.00 |
| 6746 | Pork chuck, salt | 92.0 | 65.80 | 3.80 | 61.00 | 1.0 | 5.60 | 563.40 |
| 6747 | Bologna sausage | 147.0 | 42.00 | 25.10 | 11.00 | 5.9 | 4.60 | 269.70 |
| 6750 | Codfish | 244.0 | 91.70 | 74.70 | 16.30 | .7 | 20.40 | 570.50 |
| 6751 | Codfish hash | 503.0 | 115.80 | 23.30 | 16.10 | 76.4 | 8.40 | 550.30 |
| 6752 | Butter | 422.0 | 363.70 | 1.60 | 317.60 | 44.5 | 22.70 | 3,052.00 |
| 6754 | Biscuit | 4,802.0 | 2,971.90 | 293.90 | 387.00 | 2,291.0 | 17.80 | 14,824.60 |
| 6755 | Sugar cake | 403.0 | 293.10 | 13.60 | 23.20 | 256.3 | 4.60 | 1,341.10 |
| 6756 | Gingerbread | 94.0 | 71.40 | 5.50 | 6.10 | 59.8 | 1.60 | 331.30 |
| 6757 | Molasses cookies | 55.0 | 44.20 | 3.30 | 5.30 | 35.6 | .90 | 208.40 |
| 6758 | Sugar cookies | 235.0 | 183.00 | 13.40 | 18.30 | 151.3 | .70 | 872.00 |
| 6761 | Baked beans | 2,983.0 | 1,072.80 | 235.00 | 171.20 | 666.6 | 79.20 | 5,629.00 |
| 6762 | Cabbage, boiled | 541.0 | 53.90 | 7.30 | 4.80 | 41.8 | 11.30 | 259.70 |
| 6763 | Potatoes, boiled | 508.0 | 129.00 | 8.40 | .20 | 120.4 | 3.90 | 538.50 |
| 6764 | Potato soup | 1,290.0 | 272.10 | 64.70 | 57.80 | 149.6 | 26.00 | 1,514.50 |
| 6799 | Mince pie | 838.0 | 472.00 | 34.90 | 68.20 | 368.9 | 8.00 | 2,339.50 |
| | Sugar | 241.0 | 241.00 | | | 241.0 | | 954.10 |
| | Total | 13,483.0 | 6,946.30 | 1,050.00 | 1,352.90 | 4,543.4 | 261.20 | 37,069.20 |
| 6765 | Feces (water-free) | 324.0 | 286.50 | 156.60 | 39.00 | 90.9 | 37.50 | 1,703.30 |
| | Amount digested | | 6,659.80 | 893.40 | 1,313.90 | 4,452.5 | 223.70 | 35,365.90 |
| | Per cent digested | | 95.88 | 85.09 | 97.12 | 98.0 | 85.64 | 95.45 |
| | Energy of urine | | | | | | | 1,116.80 |
| | Energy of food oxidized in the body | | | | | | | 34,249.10 |
| | Per cent of energy utilized | | | | | | | 92.39 |

## DIGESTION EXPERIMENT NO. 464.

*Kind and amounts of food.*—A mixed diet with large amounts of baked beans, corned beef, biscuits, vegetables, etc.

*Subject.*—E. F.

*Age.*—Twenty-five years.

*Weight (with clothing).*—At the beginning of the experiment, 175 pounds.

*Duration.*—Six days, with 18 meals, beginning with dinner, December 3, 1902.

The daily menu, as well as the amounts of the individual foods eaten at each meal, was as follows:

*Daily menu and amounts eaten at each meal.*

DECEMBER 3.

Dinner.—Baked beans, 350 grams; canned corned beef, 76 grams; biscuit, 380 grams; sugar cookies, 55 grams; butter, 34 grams; sugar, 13.4 grams.

Supper.—Vegetable soup, 840 grams; biscuit, 375 grams; sugar cake, 140 grams; butter, 34 grams; sugar, 13.4 grams.

DECEMBER 4.

Breakfast.—Baked beans, 178 grams; canned corned beef, 150 grams; biscuit, 150 grams; mince pie, 150 grams; butter, 13.6 grams; sugar, 13.4 grams.

Dinner.—Baked beans, 400 grams; canned corned beef, 118 grams; biscuit, 300 grams; butter, 27.2 grams; sugar, 13.4 grams.

Supper.—Corned beef, 276 grams; boiled cabbage, 890 grams; boiled potatoes, 212 grams; biscuit, 75 grams; butter, 6.8 grams; sugar, 13.4 grams.

DECEMBER 5.

Breakfast.—Baked beans, 260 grams; corned beef, 88 grams; biscuit, 150 grams; mince pie, 150 grams; butter, 13.6 grams; sugar, 13.4 grams.

Dinner.—Baked beans, 450 grams; canned corned beef, 50 grams; biscuit, 225 grams; sugar cake, 53 grams; butter, 20.4 grams; sugar, 13.4 grams.

Supper.—Boiled potatoes, 382 grams; boiled codfish, 307 grams; pork chuck, 102 grams; biscuit, 240 grams; molasses cookies, 50 grams; butter, 20.4 grams; sugar, 13.4 grams.

DECEMBER 6.

Breakfast.—Baked beans, 318 grams; biscuit, 225 grams; mince pie, 133 grams; butter, 20.4 grams; sugar, 13.4 grams.

Dinner.—Baked beans, 263 grams; biscuit, 160 grams; sugar cookies, 100 grams; butter, 13.6 grams; sugar, 13.4 grams.

Supper.—Fish hash, 589 grams; pork chuck, 81 grams; biscuit, 200 grams; sugar cookies, 55 grams; butter, 20.4 grams; sugar, 13.4 grams.

DECEMBER 7.

Breakfast.—Baked beans, 200 grams; biscuit, 150 grams; doughnuts, 94 grams; butter, 13.6 grams; sugar, 13.4 grams.

Dinner.—Baked beans, 285 grams; canned corned beef, 103 grams; biscuit, 300 grams; mince pie, 140 grams; butter, 27.2 grams; sugar, 13.4 grams.

Supper.—Vegetable soup, 911 grams; biscuit, 300 grams; molasses cookies, 63 grams; butter, 25.2 grams; sugar, 13.4 grams.

DECEMBER 8.

Breakfast.—Baked beans, 126 grams; Bologna sausage, 45 grams; biscuit, 150 grams; mince pie, 150 grams; butter, 12.6 grams; sugar, 13.4 grams.

Dinner.—Baked beans, 327 grams; Bologna sausage, 98 grams; biscuit, 225 grams; butter, 18.9 grams; sugar, 13.4 grams.

Supper.—Beef smother, 1,227 grams; boiled potatoes, 165 grams; biscuit, 75 grams; butter, 6.3 grams; sugar, 13.4 grams.

DECEMBER 9.

Breakfast.—Baked beans, 115 grams; biscuit, 225 grams; mince pie, 155 grams, butter, 18.9 grams; sugar, 13.4 grams.

TABLE 19.—*Results of digestion experiment No. 464.*

| Laboratory No. | Kind of food. | Weight of material. | Total organic matter. | Protein (N×6.25). | Fat. | Carbohydrates. | Ash. | Energy. |
|---|---|---|---|---|---|---|---|---|
| | | *Grams.* | *Grams.* | *Grams.* | *Grams.* | *Grams.* | *Grams.* | *Calories.* |
| 6743 | Beef smother | 1,227.0 | 398.20 | 170.50 | 180.80 | 46.90 | 30.30 | 2,802.50 |
| 6744 | Corned beef, boiled | 364.0 | 185.00 | 98.60 | 82.40 | 4.00 | 22.40 | 1,377.40 |
| 6745 | Corned beef, canned | 497.0 | 191.60 | 136.30 | 51.60 | 3.70 | 23.40 | 1,247.00 |
| 6746 | Pork chuck, salt | 183.0 | 130.80 | 7.60 | 121.30 | 1.90 | 11.20 | 1,120.70 |
| 6747 | Bologna sausage | 143.0 | 40.80 | 24.40 | 10.70 | 5.70 | 4.60 | 262.40 |
| 6750 | Codfish | 307.0 | 115.30 | 93.90 | 20.50 | .90 | 25.80 | 7,177.70 |
| 6751 | Codfish hash | 589.0 | 135.70 | 27.30 | 18.90 | 89.50 | 9.80 | 690.20 |
| 6752 | Butter | 347.0 | 297.90 | 1.30 | 261.10 | 35.50 | 18.70 | 2,509.90 |
| 6754 | Biscuit | 3,905.0 | 2,416.70 | 239.00 | 314.70 | 1,863.00 | 14.40 | 12,058.60 |
| 6755 | Sugar cake | 193.0 | 140.40 | 6.50 | 11.10 | 122.80 | 2.20 | 642.30 |
| 6757 | Molasses cookies | 113.0 | 90.80 | 6.70 | 11.00 | 73.10 | 1.80 | 428.30 |
| 6758 | Sugar cookies | 213.0 | 165.70 | 12.10 | 16.60 | 137.00 | .70 | 790.20 |
| 6759 | Doughnuts | 94.0 | 79.10 | 5.70 | 18.80 | 54.60 | .80 | 426.10 |
| 6761 | Baked beans | 3,275.0 | 1,178.00 | 258.00 | 188.00 | 732.00 | 87.10 | 6,180.00 |
| 6762 | Cabbage, boiled | 890.0 | 88.50 | 12.00 | 7.80 | 68.70 | 18.60 | 427.20 |
| 6763 | Potatoes, boiled | 759.0 | 192.60 | 12.60 | .20 | 179.80 | 5.80 | 804.50 |
| 6764 | Potato soup | 1,751.0 | 369.20 | 87.70 | 78.40 | 203.10 | 34.80 | 2,055.70 |
| 6799 | Mince pie | 878.0 | 494.60 | 36.60 | 71.50 | 386.50 | 8.30 | 2,450.50 |
| | Sugar | 241.0 | 241.00 | ---------- | ---------- | 241.00 | ---------- | 954.10 |
| | Total | 15,969.0 | 6,951.90 | 1,236.80 | 1,465.40 | 4,249.70 | 320.70 | 44,405.30 |
| 6766 | Feces (water-free) | 436.0 | 393.70 | 211.80 | 48.70 | 133.20 | 42.30 | 2,333.00 |
| | Amount digested | ---------- | 6,558.20 | 1,025.00 | 1,416.70 | 4,116.50 | 278.40 | 42,072.30 |
| | Per cent digested | ---------- | 94.34 | 82.87 | 96.68 | 96.68 | 86.81 | 94.73 |
| | Energy of urine | ---------- | ---------- | ---------- | ---------- | ---------- | ---------- | 1,281.30 |
| | Energy of food oxidized in body | ---------- | ---------- | ---------- | ---------- | ---------- | ---------- | 40,791.00 |
| | Per cent of energy utilized | ---------- | ---------- | ---------- | ---------- | ---------- | ---------- | 91.86 |

## DIGESTION EXPERIMENT NO. 465.

*Kind and amounts of food.*—A mixed diet with large amounts of baked beans, corned beef, biscuits, pastry, etc.

*Subject.*—E. T.

*Age.*—Twenty-five years.

*Weight (with clothing).*—At the beginning of the experiment, 155 pounds.

*Duration.*—Six days, with 18 meals, beginning with dinner, December 3, 1902.

The daily menu, as well as the amounts of the individual foods eaten at each meal, was as follows:

*Daily menu and amounts eaten at each meal.*

DECEMBER 3.

Dinner.—Baked beans, 420 grams; canned corned beef, 76 grams; biscuit, 300 grams; sugar cookies, 58 grams; butter, 27.2 grams; sugar, 13.4 grams; strawberry jelly, 50 grams.

Supper.—Vegetable soup, 690 grams; biscuit, 225 grams; sugar cake, 140 grams; sugar cookies, 100 grams; butter, 30.4 grams; sugar, 13.4 grams; strawberry jelly, 50 grams.

DECEMBER 4.

Breakfast.—Baked beans, 214 grams; canned corned beef, 49 grams; biscuit, 225 grams; sugar cookies, 38 grams; mince pie, 150 grams; butter, 20.4 grams; sugar, 13.4 grams; strawberry jelly, 50 grams.

Dinner.—Baked beans, 419 grams; canned corned beef, 103.5 grams; biscuit, 300 grams; sugar cookies, 94 grams; butter, 27.2 grams; sugar, 13.4 grams; strawberry jelly, 50 grams.

Supper.—Boiled corned beef, 160 grams; boiled cabbage, 704 grams; boiled potatoes, 242 grams; biscuit, 225 grams; sugar cookies, 35 grams; butter, 20.4 grams; sugar, 13.4 grams; strawberry jelly, 50 grams.

DECEMBER 5.

Breakfast.—Baked beans, 311 grams; boiled corned beef, 35 grams; biscuit, 225 grams; mince pie, 150 grams; butter, 20.4 grams; sugar, 13.4 grams; strawberry jelly, 50 grams.

Dinner.—Baked beans, 413 grams; canned corned beef, 118 grams; biscuit, 300 grams; sugar cookies, 65 grams; molasses cookies, 65 grams; butter, 27.2 grams; sugar, 13.4 grams; strawberry jelly, 50 grams.

Supper.—Boiled potatoes, 372 grams; boiled codfish, 387 grams; pork chuck, 111 grams; biscuit, 80 grams; molasses cookies, 100 grams; butter, 6.8 grams; sugar, 13.4 grams; strawberry jelly, 50 grams.

DECEMBER 6.

Breakfast.—Baked beans, 346 grams; biscuit, 225 grams; mince pie, 133 grams; butter, 20.4 grams; sugar, 13.4 grams; strawberry jelly, 50 grams.

Dinner.—Baked beans, 425 grams; canned corned beef, 30 grams; biscuit, 400 grams; sugar cookies, 130 grams; butter, 34 grams; sugar, 13.4 grams; strawberry jelly, 50 grams.

Supper.—Codfish hash, 518 grams; biscuit, 320 grams; molasses cookies, 55 grams; sugar cookies, 55 grams; butter, 27.2 grams; sugar, 13.4 grams; strawberry jelly, 50 grams.

DECEMBER 7.

Breakfast.—Baked beans, 201 grams; biscuit, 225 grams; doughnuts, 94 grams; sugar cookies, 26 grams; butter, 21.4 grams; sugar, 13.4 grams; strawberry jelly, 50 grams.

Dinner.—Baked beans, 295 grams; canned corned beef, 90 grams; biscuit, 300 grams; mince pie, 140 grams; butter, 25.2 grams; sugar, 13.4 grams; strawberry jelly, 50 grams.

Supper.—Vegetable soup, 596 grams; biscuit, 225 grams; sugar cookies, 63 grams; molasses cookies, 63 grams; butter, 18.9 grams; sugar, 13.4 grams.

DECEMBER 8.

Breakfast.—Baked beans, 285 grams; biscuit, 225 grams; mince pie, 140 grams; butter, 18.9 grams; sugar, 13.4 grams.

Dinner.—Baked beans, 205 grams; canned corned beef, 125 grams; biscuit, 300 grams; molasses gingerbread, 90 grams; butter, 25.2 grams; sugar, 13.4 grams.

Supper.—Beef smother, 980 grams; boiled potatoes, 270 grams; biscuit, 150 grams; molasses cookies, 140 grams; butter, 12.6 grams; sugar, 13.4 grams.

DECEMBER 9.

Breakfast.—Baked beans, 290 grams; biscuit, 225 grams; butter, 18.9 grams; sugar, 13.4 grams.

TABLE 20.—*Results of digestion experiment No. 465.*

| Laboratory No. | Kind of food. | Weight of materials. | Total organic matter. | Protein (N×6.25). | Fat. | Carbohydrates. | Ash. | Energy. |
|---|---|---|---|---|---|---|---|---|
| | | *Grams.* | *Grams.* | *Grams.* | *Grams.* | *Grams.* | *Grams.* | *Calories.* |
| 6743 | Beef smother | 980.0 | 318.00 | 136.20 | 144.40 | 37.40 | 24.20 | 2,238.30 |
| 6744 | Corned beef, boiled | 195.0 | 99.10 | 52.80 | 44.20 | 2.10 | 12.00 | 737.90 |
| 6745 | Corned beef, canned | 591.0 | 227.70 | 162.00 | 61.30 | 4.40 | 27.90 | 1,482.80 |
| 6746 | Pork chuck, salt | 111.0 | 79.30 | 4.60 | 73.60 | 1.10 | 6.80 | 679.80 |
| 6750 | Codfish | 387.0 | 145.40 | 118.40 | 25.80 | 1.20 | 32.50 | 904.80 |
| 6751 | Codfish hash | 518.0 | 119.30 | 24.00 | 16.60 | 78.70 | 8.70 | 607.10 |
| 6752 | Butter | 393.0 | 337.40 | 1.50 | 295.70 | 40.20 | 21.20 | 2,842.60 |
| 6754 | Biscuit | 4,475.0 | 2,769.60 | 273.90 | 360.70 | 2,135.00 | 16.50 | 13,818.80 |
| 6755 | Sugar cake | 166.0 | 120.80 | 5.60 | 9.60 | 105.60 | 1.90 | 552.40 |
| 6756 | Gingerbread | 90.0 | 68.30 | 5.30 | 5.80 | 57.20 | 1.50 | 317.20 |
| 6757 | Molasses cookies | 423.0 | 339.50 | 25.10 | 41.00 | 273.40 | 6.90 | 1,603.20 |
| 6758 | Sugar cookies | 638.0 | 496.60 | 36.30 | 49.60 | 410.70 | 1.90 | 2,367.00 |
| 6759 | Doughnuts | 94.0 | 79.10 | 5.70 | 18.80 | 54.60 | .80 | 426.10 |
| 6761 | Baked beans | 3,824.0 | 1,375.50 | 301.30 | 219.50 | 854.70 | 101.70 | 7,215.90 |
| 6762 | Cabbage, boiled | 704.0 | 70.10 | 9.50 | 6.20 | 54.40 | 14.70 | 337.90 |
| 6763 | Potatoes, boiled | 884.0 | 224.40 | 14.70 | .30 | 209.40 | 6.80 | 937.20 |
| 6764 | Potato soup | 1,286.0 | 271.20 | 64.40 | 57.60 | 149.20 | 25.50 | 1,510.00 |
| 6799 | Mince pie | 713.0 | 401.60 | 29.70 | 58.00 | 313.90 | 6.80 | 1,990.00 |
| 6724 | Strawberry jelly | 650.0 | 539.50 | ---------- | ---------- | 539.50 | ---------- | 2,211.40 |
| | Sugar | 241.0 | 241.00 | ---------- | ---------- | 241.00 | ---------- | 954.10 |
| | Total | 17,363.0 | 8,323.40 | 1,271.40 | 1,488.70 | 5,563.70 | 318.30 | 43,735.00 |
| 6767 | Feces (water-free) | 339.9 | 311.20 | 156.30 | 25.70 | 129.20 | 28.70 | 1,790.30 |
| | Amount digested | ---------- | 8,012.20 | 1,115.10 | 1,463.00 | 5,434.50 | 289.60 | 41,944.70 |
| | Per cent digested | ---------- | 96.26 | 87.70 | 98.27 | 97.68 | 90.98 | 95.96 |
| | Energy of urine | ---------- | ---------- | ---------- | ---------- | ---------- | ---------- | 1,393.40 |
| | Energy of food oxidized in the body | ---------- | ---------- | ---------- | ---------- | ---------- | ---------- | 40,551.30 |
| | Per cent of energy utilized | ---------- | ---------- | ---------- | ---------- | ---------- | ---------- | 92.72 |

## DIGESTION EXPERIMENT NO. 466.

*Kind and amounts of food.*—A mixed diet, with large amounts of baked beans, meat, and salt fish, potatoes, biscuits, pastry, etc.

*Subject.*—O. B.

*Age.*—Twenty-six years.

*Weight (with clothing).*—At the beginning of the experiment, 183 pounds.

*Duration.*—Six days, with 18 meals, beginning with supper January 21, 1903.

The daily menu, as well as the amounts of the individual foods eaten at each meal, was as follows:

*Daily menu and amounts eaten at each meal.*

JANUARY 21.

Supper.—Boiled potatoes, 380 grams; boiled codfish, 140 grams; biscuit, 140 grams; bread pudding, 570 grams; molasses cookies, 35 grams; sugar, 26 grams; sirup, 5.5 grams.

JANUARY 22.

Breakfast.—Baked beans, 217 grams; biscuit, 240 grams; sugar cookies, 51 grams; mince pie, 137 grams; sugar, 26 grams; sirup, 5.5 grams.

Dinner.—Baked beans, 359 grams; Bologna sausage, 145 grams; biscuit, 306 grams; sugar cookies, 54 grams; sugar, 26 grams; sirup, 5.5 grams.

Supper.—Boiled potatoes, 714 grams; boiled corned beef, 232 grams; biscuit, 70 grams; molasses doughnuts, 95 grams; sugar, 26 grams; sirup, 5.5 grams.

JANUARY 23.

Breakfast.—Baked beans, 285 grams; biscuit, 210 grams; molasses doughnuts, 60 grams; mince pie, 86 grams; sugar, 26 grams; sirup, 5.5 grams.

Dinner.—Baked beans, 415 grams; biscuit, 275 grams; sugar cookies, 160 grams; sugar, 26 grams; sirup, 5.5 grams.

Supper.—Boiled potatoes, 503 grams; boiled codfish, 188 grams; biscuit, 70 grams; bread pudding, 441 grams; sugar, 26 grams; sirup, 5.5 grams.

JANUARY 24.

Breakfast.—Baked beans, 335 grams; biscuit, 216 grams; sugar cookies, 50 grams; sugar doughnuts, 50 grams; mince pie, 140 grams; sugar, 26 grams; sirup, 5.5 grams.

Dinner.—Baked beans, 260 grams; biscuit, 246 grams; molasses doughnuts, 57 grams; sugar, 26 grams; sirup, 5.5 grams.

Supper.—Boiled potatoes, 700 grams; roast beef, 240 grams; biscuit, 140 grams; sugar cookies, 100 grams; sugar, 26 grams; sirup, 5.5 grams.

JANUARY 25.

Breakfast.—Baked beans, 113 grams; biscuit, 140 grams; sugar doughnuts, 92 grams; roast beef, 26 grams; sugar, 26 grams; sirup, 5.5 grams.

Dinner.—Baked beans, 264 grams; roast beef, 40 grams; biscuit, 270 grams; mince pie, 262 grams; sugar, 26 grams; sirup, 5.5 grams.

Supper.—Boiled potatoes, 545 grams; roast beef, 125 grams; biscuit, 70 grams; molasses cookies, 50 grams; mince pie, 260 grams; sugar, 26 grams; sirup, 5.5 grams.

JANUARY 26.

Breakfast.—Baked beans, 210 grams; biscuit, 140 grams; sugar doughnuts, 100 grams; mince pie, 125 grams; sugar, 26 grams; sirup, 5.5 grams.

Dinner.—Baked beans, 380 grams; biscuit, 320 grams; molasses cookies, 135 grams; sugar, 26 grams; sirup, 5.5 grams.

Supper.—Vegetable soup, 618 grams; biscuit, 280 grams; sugar cookies, 50 grams; sugar, 26 grams; sirup, 5.5 grams.

JANUARY 27.

Breakfast.—Baked beans, 250 grams; corned beef, 76 grams; biscuit, 280 grams; mince pie, 120 grams; sugar, 26 grams; sirup, 5.5 grams.

Dinner.—Baked beans, 315 grams; biscuit, 320 grams; gingerbread, 145 grams; sugar, 26 grams; sirup, 5.5 grams.

TABLE 21.—*Results of digestion experiment No. 466.*

| Laboratory No. | Kind of food. | Weight of materials. | Total organic matter. | Protein (N×6.25). | Fat. | Carbohydrates. | Ash. | Energy. |
|---|---|---|---|---|---|---|---|---|
| | | *Grams.* | *Grams.* | *Grams.* | *Grams.* | *Grams.* | *Grams.* | *Calories.* |
| 6783 | Corned beef, boiled | 308.0 | 180.00 | 30.90 | 118.80 | 30.30 | 11.10 | 1,371.00 |
| 6784 | Roast beef | 431.0 | 174.70 | 139.90 | 34.80 | ---------- | 7.90 | 900.60 |
| 6786 | Bologna sausage | 145.0 | 43.10 | 20.90 | 16.40 | 5.80 | 5.90 | 295.70 |
| 6750 | Codfish | 328.0 | 123.20 | 100.30 | 21.90 | 1.00 | 27.50 | 767.00 |
| 6787 | Baked beans | 3,403.0 | 1,267.80 | 275.30 | 255.90 | 736.60 | 106.20 | 6,994.00 |
| 6789 | Potatoes, boiled | 2,842.0 | 651.80 | 54.00 | .80 | 603.00 | 22.20 | 2,779.50 |
| 6790 | Vegetable soup | 618.0 | 86.50 | 22.20 | 14.50 | 49.80 | 8.50 | 467.20 |
| 6791 | Biscuit | 3,733.0 | 2,425.60 | 247.10 | 255.00 | 1,923.50 | 19.40 | 11,930.00 |
| 6792 | Sugar cookies | 465.0 | 387.20 | 26.40 | 54.20 | 306.60 | 3.30 | 1,728.00 |
| 6793 | Sugar doughnuts | 242.0 | 205.40 | 11.20 | 65.40 | 128.80 | 1.10 | 1,172.80 |
| 6794 | Molasses cookies | 220.0 | 172.40 | 11.90 | 22.30 | 138.20 | 5.10 | 850.10 |
| 6795 | Gingerbread | 145.0 | 111.70 | 8.60 | 12.30 | 90.80 | 2.70 | 539.50 |
| 6796 | Molasses doughnuts | 212.0 | 170.50 | 10.00 | 41.90 | 118.60 | 2.20 | 949.50 |
| 6797 | Bread pudding | 1,011.0 | 625.80 | 32.50 | 44.10 | 549.20 | 18.00 | 2,884.20 |
| 6798 | Mince pie | 1,130.0 | 709.20 | 53.50 | 128.10 | 527.60 | 7.50 | 3,604.20 |
| | Sugar | 468.0 | 468.00 | ---------- | ---------- | 468.00 | ---------- | 1,852.70 |
| | Molasses | 99.0 | 69.60 | 2.30 | ---------- | 67.30 | ---------- | 276.70 |
| | Total | 15,800.0 | 7,878.50 | 1,047.00 | 1,086.40 | 5,745.10 | 251.70 | 39,362.70 |
| 6800 | Feces (water-free) | 328.0 | 297.40 | 173.10 | 31.20 | 92.10 | 30.60 | 1,804.70 |
| | Amount digested | ---------- | 7,581.10 | 873.90 | 1,055.20 | 5,652.00 | 221.10 | 37,558.00 |
| | Per cent digested | ---------- | 96.23 | 83.47 | 97.13 | 98.38 | 87.84 | 95.42 |
| | Energy of urine | ---------- | ---------- | ---------- | ---------- | ---------- | ---------- | 1,092.40 |
| | Energy of food oxidized in the body | ---------- | ---------- | ---------- | ---------- | ---------- | ---------- | 36,465.60 |
| | Per cent of energy utilized | ---------- | ---------- | ---------- | ---------- | ---------- | ---------- | 92.64 |

## DIGESTION EXPERIMENT NO. 467.

*Kind and amounts of food.*—A mixed diet with large amounts of baked beans, codfish, vegetables, biscuit, pastry, etc.

*Subject.*—A. C.

*Age.*—Twenty-five years.

*Weight (with clothing).*—At the beginning of the experiment, 150 pounds.

*Duration.*—Six days, with 18 meals, beginning with supper, January 21, 1903.

The daily menu, as well as the amounts of the individual foods eaten at each meal, was as follows:

*Daily menu and amounts eaten at each meal.*

JANUARY 21.

Supper.—Boiled potatoes, 220 grams; boiled codfish, 130 grams; biscuit, 140 grams; bread pudding, 260 grams; molasses cookies, 135 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

JANUARY 22.

Breakfast.—Baked beans, 241 grams; pork chuck, 30 grams; biscuit, 240 grams; mince pie, 137 grams; butter, 5.3 grams; sugar, 26 grams; sirup, 5.5 grams.

Dinner.—Baked beans, 350 grams; pork chuck, 35 grams; biscuit, 166 grams; sugar cookies, 54 grams; butter, 5.3 grams; sugar, 26 grams; sirup, 5.5 grams.

Supper.—Boiled potatoes, 773 grams; boiled cabbage, 439 grams; boiled corned

beef, 126 grams; biscuit, 140 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

JANUARY 23.

Breakfast.—Baked beans, 345 grams; biscuit, 210 grams; mince pie, 86 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

Dinner.—Baked beans, 340 grams; biscuit, 208 grams; pork chuck, 48 grams; sugar cookies, 42 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

Supper.—Boiled potatoes, 231 grams; boiled codfish, 188 grams; biscuit, 140 grams; bread pudding, 302 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

JANUARY 24.

Breakfast.—Baked beans, 334 grams; biscuit, 216 grams; mince pie, 140 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

Dinner.—Baked beans, 320 grams; biscuit, 128 grams; molasses doughnuts, 151 grams; pork chuck, 40 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

Supper.—Boiled potatoes, 240 grams; roast beef, 195 grams; biscuit, 140 grams; sugar cookies, 50 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

JANUARY 25.

Breakfast.—Baked beans, 319 grams; roast beef, 39 grams; biscuit, 140 grams; sugar cookies, 56 grams; sugar doughnuts, 46 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

Dinner.—Baked beans, 325 grams; roast beef, 35 grams; biscuit, 106 grams; sugar doughnuts, 46 grams; mince pie, 131 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

Supper.—Boiled potatoes, 255 grams; roast beef, 150 grams; biscuit, 140 grams; sugar, 26 grams; butter, 5.5 grams; sirup, 5.3 grams.

JANUARY 26.

Breakfast.—Baked beans, 195 grams; biscuit, 210 grams; sugar doughnuts, 45 grams; mince pie, 125 grams; sugar, 26 grams; butter, 5.3 grams; sirup, 5.5 grams.

Dinner.—Baked beans, 310 grams; pork chuck, 75 grams; biscuit, 180 grams; molasses cookies, 100 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

Supper.—Vegetable soup, 784 grams; biscuit, 140 grams; sugar cookies, 50 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

JANUARY 27.

Breakfast.—Baked beans, 350 grams; biscuit, 140 grams; corned beef, 37 grams; mince pie, 120 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

Dinner.—Baked beans, 345 grams; biscuit, 235 grams; molasses gingerbread, 145 grams; pork chuck, 37 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

TABLE 22.—*Results of digestion experiment No. 467.*

| Laboratory No. | Kind of food. | Weight of material. | Total organic matter. | Protein (N×6.25). | Fat. | Carbohydrates. | Ash. | Energy. |
|---|---|---|---|---|---|---|---|---|
| | | *Grams.* | *Grams.* | *Grams.* | *Grams.* | *Grams.* | *Grams.* | *Calories.* |
| 6783 | Corned beef, boiled | 163.0 | 95.30 | 16.40 | 62.90 | 16.00 | 5.80 | 725.80 |
| 6784 | Roast beef | 419.0 | 169.70 | 135.90 | 33.80 | ---------- | 7.70 | 875.40 |
| 6746 | Pork chuck, salt | 265.0 | 189.30 | 11.00 | 175.50 | 2.70 | 16.20 | 1,623.00 |
| 6750 | Codfish, boiled | 318.0 | 119.50 | 97.30 | 21.30 | .90 | 26.70 | 743.60 |
| 6752 | Butter | 95.4 | 82.00 | .30 | 71.70 | 10.00 | 5.10 | 690.00 |
| 6786 | Baked Beans | 3,774.0 | 1,405.90 | 305.30 | 283.80 | 816.80 | 117.70 | 7,757.00 |
| 6788 | Cabbage, boiled | 439.0 | 55.60 | 6.80 | 18.10 | 30.70 | 11.70 | 321.80 |
| 6789 | Potatoes, boiled | 1,719.0 | 398.00 | 32.70 | .50 | 364.80 | 11.40 | 1,681.30 |
| 6790 | Vegetable soup | 784.0 | 109.80 | 28.20 | 18.40 | 63.20 | 101.80 | 592.70 |
| 6791 | Biscuit | 3,021.0 | 1,963.30 | 200.00 | 206.30 | 1,557.00 | 15.70 | 9,656.00 |
| 6792 | Sugar cookies | 252.0 | 209.80 | 14.30 | 29.30 | 166.20 | 1.80 | 936.50 |
| 6793 | Sugar doughnuts | 137.0 | 116.20 | 6.30 | 37.00 | 72.90 | .60 | 664.00 |
| 6794 | Molasses cookies | 235.0 | 184.20 | 12.80 | 23.80 | 147.60 | 5.40 | 908.20 |
| 6795 | Gingerbread | 145.0 | 111.70 | 8.60 | 12.30 | 90.80 | 2.70 | 539.50 |
| 6796 | Molasses doughnuts | 151.0 | 121.50 | 7.10 | 29.90 | 84.50 | 1.60 | 676.30 |
| 6797 | Bread pudding | 562.0 | 347.90 | 18.00 | 24.60 | 305.30 | 10.00 | 1,603.20 |
| 6798 | Mince pie | 739.0 | 463.80 | 35.00 | 83.80 | 345.00 | 4.90 | 2,356.50 |
| | Sugar | 468.0 | 468.00 | ---------- | ---------- | 468.00 | ---------- | 1,842.80 |
| | Molasses | 99.0 | 69.60 | 2.30 | ---------- | 67.30 | ---------- | 276.70 |
| | Total | 13,785.4 | 6,681.10 | 938.30 | 1,133.10 | 4,609.70 | 258.90 | 34,470.30 |
| 6801 | Feces | 284.3 | 253.90 | 139.80 | 29.80 | 84.30 | 30.40 | 1,502.20 |
| | Amount digested | ---------- | 6,427.20 | 798.50 | 1,103.30 | 4,525.40 | 227.50 | 32,968.10 |
| | Per cent digested | ---------- | 96.19 | 85.10 | 97.37 | 98.17 | 87.87 | 95.64 |
| | Energy of urine | ---------- | ---------- | ---------- | ---------- | ---------- | ---------- | 998.10 |
| | Energy of food oxidized in the body | ---------- | ---------- | ---------- | ---------- | ---------- | ---------- | 31,970.00 |
| | Per cent of energy utilized | ---------- | ---------- | ---------- | ---------- | ---------- | ---------- | 92.75 |

## DIGESTION EXPERIMENT NO. 468.

*Kind and amounts of food.*—A mixed diet, with large amounts of baked beans, corned beef, codfish, potatoes, biscuit, etc.

*Subject.*—F. St. P.

*Age.*—Twenty-four years.

*Weight (with clothing).*—At the beginning of the experiment, 173 pounds.

*Duration.*—Six days, with 18 meals, beginning with supper, January 21, 1903.

The daily menu, as well as the amounts of the individual foods eaten at each meal, was as follows:

*Daily menu and amounts eaten at each meal.*

JANUARY 21.

Supper.—Boiled potatoes, 735 grams; boiled codfish, 208 grams; biscuit, 140 grams; molasses cookies, 35 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

JANUARY 22.

Breakfast.—Baked beans, 226 grams; pork chuck, 38 grams; biscuit, 160 grams; sugar cookies, 51 grams; sugar, 26 grams; sirup 5.5 grams; butter, 5.3 grams.

Dinner.—Boiled potatoes, 175 grams; baked beans, 119 grams; pork chuck, 50 grams; biscuit, 113 grams; sugar cookies, 53 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

Supper.—Boiled potatoes, 445 grams; boiled corned beef, 130 grams; boiled cabbage, 500 grams; biscuit, 70 grams; molasses doughnuts, 77 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

JANUARY 23.

Breakfast.—Baked beans, 313 grams; biscuit, 140 grams; molasses doughnuts, 55 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

Dinner.—Boiled cabbage, 210 grams; boiled corned beef, 120 grams; biscuit, 274 grams; sugar cookies, 100 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

Supper.—Boiled potatoes, 243 grams; boiled codfish, 177 grams; biscuit, 140 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

JANUARY 24.

Breakfast.—Baked beans, 194 grams; biscuit, 174 grams; sugar cookies, 50 grams; sugar doughnuts, 56 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

Dinner.—Baked beans, 155 grams; biscuit, 267 grams; sugar doughnuts, 112 grams; sugar cookies, 50 grams; pork chuck, 26 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

Supper.—Boiled potatoes, 407 grams; roast beef, 195 grams; biscuit, 140 grams; sugar cookies, 50 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

JANUARY 25.

Breakfast.—Baked beans, 106 grams; biscuit, 140 grams; sugar cookies, 56 grams; sugar doughnuts, 92 grams; roast beef, 60 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

Dinner.—Baked beans, 190 grams; roast beef, 40 grams; biscuit, 108 grams; sugar doughnuts, 138 grams; mince pie, 131 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

Supper.—Boiled potatoes, 400 grams; roast beef, 160 grams; biscuit, 140 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

JANUARY 26.

Breakfast.—Baked beans, 205 grams; biscuit, 140 grams; sugar doughnuts, 45 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

Dinner.—Baked beans, 180 grams; roast beef, 89 grams; biscuit, 187 grams; sugar cookies, 120 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

Supper.—Vegetable soup, 1,408 grams; biscuit, 140 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

JANUARY 27.

Breakfast.—Baked beans, 320 grams; biscuit, 140 grams; sugar cookies, 50 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

Dinner.—Baked beans, 142 grams; vegetable soup, 420 grams; biscuit, 208 grams; gingerbread, 121 grams; sugar, 26 grams; sirup, 5.5 grams; butter, 5.3 grams.

TABLE 23.—*Results of digestion experiment No. 468.*

| Laboratory No. | Kind of food. | Weight of materials. | Total organic matter. | Protein (N×6.25). | Fat. | Carbohydrates. | Ash. | Energy. |
|---|---|---|---|---|---|---|---|---|
| | | *Grams.* | *Grams.* | *Grams.* | *Grams.* | *Grams.* | *Grams.* | *Calories.* |
| 6783 | Corned beef, boiled | 250.0 | 146.10 | 25.10 | 95.40 | 24.60 | 9.00 | 1,113.00 |
| 6784 | Roast beef | 544.0 | 220.40 | 176.50 | 43.90 | ---------- | 9.90 | 1,136.00 |
| 6746 | Pork chuck, salt | 114.0 | 81.50 | 4.70 | 75.60 | 1.20 | 7.00 | 698.20 |
| 6750 | Codfish | 385.0 | 144.60 | 117.80 | 25.70 | 1.10 | 32.30 | 900.30 |
| 6752 | Butter | 95.4 | 82.00 | .30 | 71.70 | 10.00 | 5.10 | 690.00 |
| 6787 | Baked beans | 2,150.0 | 800.90 | 173.90 | 161.70 | 465.30 | 67.10 | 4,419.00 |
| 6788 | Cabbage, boiled | 710.0 | 89.80 | 10.90 | 29.30 | 49.60 | 18.90 | 520.40 |
| 6789 | Potatoes, boiled | 2,405.0 | 556.80 | 45.70 | .70 | 510.40 | 18.70 | 2,352.00 |
| 6790 | Vegetable soup | 1,828.0 | 255.80 | 65.60 | 42.90 | 147.30 | 25.20 | 1,382.00 |
| 6791 | Biscuit | 2,821.0 | 1,833.00 | 186.80 | 192.70 | 1,453.50 | 14.70 | 9,017.00 |
| 6792 | Sugar cookies | 560.0 | 466.40 | 31.80 | 65.30 | 369.30 | 3.90 | 2,081.00 |
| 6793 | Sugar doughnuts | 443.0 | 375.90 | 20.40 | 119.80 | 235.70 | 2.00 | 2,147.00 |
| 6794 | Molasses cookies | 35.0 | 27.40 | 1.90 | 3.50 | 22.00 | .80 | 135.30 |
| 6795 | Gingerbread | 121.0 | 93.10 | 7.10 | 10.20 | 75.80 | 2.30 | 450.20 |
| 6796 | Molasses doughnuts | 132.0 | 106.20 | 6.20 | 26.10 | 73.90 | 1.40 | 591.20 |
| 6798 | Mince pie | 131.0 | 82.30 | 6.20 | 14.90 | 61.20 | .70 | 307.80 |
| | Sugar | 468.0 | 468.00 | ---------- | ---------- | 468.00 | ---------- | 1,842.80 |
| | Sirup | 99.0 | 69.60 | 2.30 | ---------- | 67.30 | 3.10 | 276.70 |
| | Total | 13,291.4 | 5,899.80 | 883.20 | 980.40 | 4,036.20 | 222.10 | 30,069.90 |
| 6802 | Feces | 208.6 | 188.40 | 106.70 | 21.10 | 60.60 | 20.20 | 1,122.70 |
| | Amount digested | ---------- | 5,711.40 | 776.50 | 959.30 | 3,975.60 | 201.90 | 28,947.20 |
| | Per cent digested | ---------- | 96.81 | 87.92 | 97.84 | 98.59 | 90.90 | 96.37 |
| | Energy of urine | ---------- | ---------- | ---------- | ---------- | ---------- | ---------- | 970.60 |
| | Energy of food oxidized in the body | ---------- | ---------- | ---------- | ---------- | ---------- | ---------- | 27,976.60 |
| | Per cent of energy utilized | ---------- | ---------- | ---------- | ---------- | ---------- | ---------- | 93.00 |

## METABOLIC PRODUCTS IN THE FECES.

The feces are not made up entirely of undigested food residues, but contain quite a large amount of other waste materials, usually termed metabolic products. As ordinarily used, however, this term not only includes the metabolic products, strictly speaking, such as the residues from the bile, mucus, saliva, gastric, pancreatic, and other digestive secretions, but also includes worn-out particles from the mucous membrane, lining of the intestines, other débris from the walls of the stomach, and, perhaps, larger or smaller quantities of specifically excretory matters. The results of other investigations indicate that the digestion of food materials is more complete and the proportion of metabolic products in the feces larger than was formerly supposed. It is not at all improbable that during the processes of natural digestion, aided by careful preparation of the food and proper mastication, practically all of the nutrients of most foods are rendered absorbable in the alimentary canal, and that undigested residues are rather accidental than incidental. In view of the importance of this subject the metabolic nitrogen of the feces in these digestion experiments has been studied by the same method as in the past. The metabolic nitrogen was determined by two methods described in detail in a previous bulletin of this Office.[a] In the first, the metabolic products are removed by digestion with pepsin solution, and in the second, by treatment with ether, alcohol, hot water,

[a] U. S. Dept. Agr., Office of Experiment Stations Bul. 85.

and cold limewater. The results obtained by these methods, and the coefficients of digestibility of nitrogen (protein) in the different experiments when corrections are applied according to the data thus obtained, are given in the table which follows:

TABLE 24.—*Coefficients of digestibility of nitrogen (protein) of food when allowance is made for nitrogen of metabolic products in feces.*

[Mixed diet.]

| Experiment. | Nitrogen in food. | Weight of water-free feces. | Total nitrogen in feces. | | Feces treated with pepsin. | | | | Feces treated with ether, alcohol, hot water, and limewater. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Nitrogen in feces not dissolved. | | Corrected digestibility of nitrogen of food. | | Nitrogen in feces not dissolved. | | Corrected digestibility of nitrogen of food. | |
| | *Grams.* | *Grams.* | *P. ct.* | *Grams.* | *P. ct.* | *Grams.* | *Grams.* | *Per ct.* | *P. ct.* | *Grams.* | *Grams.* | *P. ct.* |
| No. 463 | 168.0 | 351.0 | 7.13 | 25.02 | 2.04 | 7.16 | 160.84 | 95.73 | 2.97 | 10.42 | 157.58 | 93.79 |
| No. 464 | 197.9 | 473.0 | 7.17 | 33.91 | 2.12 | 10.03 | 187.87 | 94.93 | 3.11 | 14.71 | 183.19 | 92.56 |
| No. 465 | 203.4 | 371.6 | 6.73 | 25.01 | 2.22 | 8.25 | 195.15 | 95.94 | 3.62 | 13.45 | 189.95 | 93.38 |
| No. 466 | 167.5 | 363.0 | 7.63 | 27.70 | 2.52 | 9.15 | 158.35 | 94.54 | 4.16 | 15.10 | 152.40 | 90.98 |
| No. 467 | 150.1 | 309.4 | 7.23 | 22.37 | 2.46 | 7.61 | 142.49 | 94.93 | 4.04 | 12.49 | 137.61 | 91.67 |
| No. 468 | 141.3 | 230.4 | 7.41 | 17.07 | 2.16 | 4.98 | 136.30 | 96.46 | 3.61 | 8.32 | 132.98 | 94.11 |

## SUMMARY OF RESULTS OF DIGESTION EXPERIMENTS.

In the following table are summarized the coefficients of digestibility of the nutrients and availability of the energy in the food eaten in the digestion experiments with lumbermen who were on a mixed diet. In the case of protein the values are given as determined and as corrected for metabolic products in the feces.

TABLE 25.—*Summary of results, including corrected values for protein, of digestion experiments with Maine lumbermen.*

[Mixed diet.]

| Experiment. | Total organic matter. | Protein. | | | Fat. | Carbohydrates. | Ash. | Fuel value. |
|---|---|---|---|---|---|---|---|---|
| | | Not corrected. | Corrected by pepsin method. | Corrected by ether, alcohol, etc., method. | | | | |
| | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* | *Per ct.* | *Per cent.* | *Per ct.* | *Per ct.* |
| No. 463 | 95.9 | 85.1 | 95.7 | 93.8 | 97.1 | 98.0 | 85.6 | 92.4 |
| No. 464 | 94.3 | 82.9 | 94.9 | 92.6 | 96.7 | 96.7 | 86.8 | 91.8 |
| No. 465 | 96.3 | 87.7 | 95.9 | 93.4 | 98.3 | 97.7 | 91.0 | 92.7 |
| Average | 95.5 | 85.2 | 95.5 | 93.3 | 97.3 | 97.5 | 87.8 | 92.3 |
| No. 466 | 96.2 | 83.5 | 94.5 | 91.0 | 97.1 | 98.4 | 87.8 | 92.6 |
| No. 467 | 96.2 | 85.1 | 94.9 | 91.7 | 97.4 | 98.2 | 87.9 | 92.8 |
| No. 468 | 96.8 | 87.9 | 96.5 | 94.1 | 97.8 | 98.5 | 90.9 | 93.0 |
| Average | 96.4 | 85.3 | 95.3 | 92.3 | 97.4 | 98.4 | 88.9 | 92.8 |
| Average of all | 96.0 | 85.3 | 95.4 | 92.8 | 97.4 | 98.0 | 88.4 | 92.6 |

The digestion experiments with Maine lumbermen were undertaken principally to secure data for estimating the proportions of the

nutrients of a mixed diet actually utilized by the body under the experimental conditions previously noted. As may be seen from the figures summarized above, the results for the different subjects were for the most part quite uniform, the range in percentages of digestibility of the different nutrients being from 82.9 to 87.9 for protein, 96.7 to 98.3 for fat, and 96.7 to 98.5 for carbohydrates, while the availability of energy ranged from 91.8 to 93 per cent. The average of the results for all six subjects, i. e., protein 85.3 per cent, fat 97.4 per cent, carbohydrates 98 per cent, and energy 92.6 per cent, therefore, gives a fair indication of the digestibility of the nutrients and availability of the energy of the diet under the conditions of these experiments.

On the basis of a large amount of data obtained in upward of 400 digestion experiments made in connection with the nutrition investigations of this Office, of which those here reported form a part, it has been estimated that on the average about 92 per cent of the protein, 95 per cent of the fat, 97 per cent of the carbohydrates, and 91 per cent of the energy of ordinary mixed diet is digested and made available to the body. It will be noticed that except in the case of the protein there is a fairly close agreement between these factors and the average of the results of the digestion experiments summarized above. The discrepancy in the case of the protein may doubtless be accounted for by differences in the proportion of animal and vegetable protein in the diet. That is, in the diet of the present experiments, as shown by the figures in Table 28 beyond, about 60 per cent of the total protein on the average was derived from vegetable food and only 40 per cent from animal food, whereas in the experiments upon which the above-mentioned factors were based the average proportion of protein from animal foods was more nearly 60 per cent and that from vegetable foods 40 per cent. Since the digestibility of vegetable protein is lower than that of animal food, obviously the digestibility of total protein would be lower in the diet in which vegetable protein predominates, as in the present case.

If these facts be taken into consideration it would appear that the men in these experiments digested the protein of their diet, as well as the other nutrients, in very nearly the proportions that have been found for the average individual on ordinary mixed diet. This may be illustrated by a comparison between the results actually determined in the experiments and those calculated from the data of food eaten by use of factors representing the average digestibility of the nutrients in different classes of food materials. Such factors, deduced mainly from the results of the large number of digestion experiments referred to above, are here given.[a]

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[a] Connecticut Storrs Station Rpt. 1899, p. 86.

TABLE 26.—*Coefficients of digestibility of nutrients of different groups of food materials and of total nutrients of mixed diet.*

| | Protein. | Fat. | Carbohydrates. |
|---|---|---|---|
| | *Per cent.* | *Per cent.* | *Per cent.* |
| Animal foods | 97 | 95 | 98 |
| Cereals | 85 | 90 | 98 |
| Legumes, dried (beans and peas) | 78 | 90 | 97 |
| Sugars and starches | | | 98 |
| Vegetables | 83 | 90 | 95 |
| Fruits | 85 | 90 | 90 |
| Vegetable foods | 85 | 90 | 97 |
| Total food | 92 | 95 | 97 |

On the assumption that the nutrients of the different classes of food materials in the diet eaten during the experiment would be digested in the proportions given in the above table, the digestibility of each nutrient in the total diet would be for each experiment as given in the columns headed "Calculated" in the following table, while the results actually found are given in the columns headed "Determined."

TABLE 27.—*Comparison of coefficients of digestibility as found by actual experiment and as calculated by factors in experiments Nos. 463–468.*

| Experiment. | Protein. | | Fat. | | Carbohydrates. | |
|---|---|---|---|---|---|---|
| | Determined. | Calculated. | Determined. | Calculated. | Determined. | Calculated. |
| | *P. ct.* | *P. ct.* | *P. ct.* | *P. ct.* | *P. ct.* | *P. ct.* |
| No. 463 | 85.09 | 87.90 | 97.12 | 94.78 | 98.00 | 97.28 |
| No. 464 | 82.87 | 89.14 | 96.68 | 94.94 | 96.68 | 97.08 |
| No. 465 | 87.70 | 88.16 | 98.27 | 94.94 | 97.68 | 96.58 |
| No. 466 | 83.47 | 86.96 | 97.13 | 94.95 | 98.38 | 97.16 |
| No. 467 | 85.10 | 86.37 | 97.37 | 94.86 | 98.17 | 97.23 |
| No. 468 | 87.92 | 87.84 | 97.84 | 94.83 | 98.49 | 97.30 |
| Average of six studies | 85.36 | 87.73 | 97.40 | 94.88 | 97.90 | 97.11 |

In every case but one the agreement between the calculated coefficients and those actually found is reasonably close, and would indicate, as expressed above, that these men, under the experimental conditions already described, digested the nutrients of their diet in about the same proportions as have been found for the average individual on an ordinary mixed diet. The exception noted is that of the digestion of protein by the subject in experiment No. 464, with whom the result actually found was noticeably lower than that calculated by average coefficients. This discrepancy between the results as calculated and as actually found in the case of this man would suggest that he digested either animal protein, or perhaps both animal and vegetable protein, less thoroughly than has been found in the average with other individuals. The reason why the deficiency would seem rather to be with the animal protein is found in the fact that the pro-

portion of protein from animal food in the diet of this subject was larger than in that of either of the others, as shown by the data in Table 28.

The coefficients of digestibility of protein, when corrections are made for metabolic products in the feces, are of course larger than those found by deducting the total feces from the total food consumed, as shown by the data in Table 25 (page 52). It should be observed that the corrections for metabolic products obtained by the two methods followed differ somewhat, the digestibility being higher when corrections are introduced in accordance with results obtained by the pepsin method. This is perhaps accounted for by the fact that treating the feces with pepsin would undoubtedly remove protein of undigested food material as well as metabolic products, while treatment with solvents (ether, alcohol, and limewater) would not affect the protein of undigested residue. However, too little information is available at present for a satisfactory discussion of this point.

## SOURCES OF THE NUTRIENTS.

Since numerous investigations have shown that animal foods are more completely digested than those of vegetable origin, it was thought interesting in these experiments with a man on a mixed diet to determine as nearly as possible the sources of the different nutrients—that is, the proportion derived from animal and vegetable foods. Several of the food materials were of a mixed character, so a somewhat arbitrary classification was necessary; thus, in the case of codfish hash and vegetable soup it was assumed that all the carbohydrates and a part of the protein and fat were furnished by the potatoes used in making them, the amount of protein and fat being calculated from the average values for these nutrients in boiled potatoes. The rest of the protein and fat was assumed to be of animal origin. Similarly, in the case of mince pie, two-thirds of the protein and fat were considered as of animal origin, and the remaining protein and fat and all the carbohydrates were assumed to be of vegetable origin. The larger part of the fat of baked beans was not derived from the beans themselves, but from the pork added. This amounted on an average to nearly 16 per cent of the total fat of the food, and in the accompanying table is classed with the animal fats. While this apportionment is only a rough approximation it seemed to be the best that could be devised and is sufficiently accurate for the purpose. The data regarding the source of the different nutrients are summarized in the following table:

TABLE 28.—*Relative amounts of nutrients and energy supplied by different food materials.*

| Kind of food. | Protein. | Fat. | Carbohydrates. | Ash. | Energy. |
|---|---|---|---|---|---|
| Digestion experiment No. 463: | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* |
| Baked beans | 22.37 | [a] 1.39 | 14.67 | 15.16 | 11.56 |
| Other vegetable food | 37.07 | 34.56 | 84.44 | 24.57 | 52.67 |
| Total vegetable food | 59.44 | 35.95 | 99.11 | 39.73 | 71.23 |
| Total animal food | 40.56 | 64.05 | .89 | 60.27 | 28.77 |
| Digestion experiment No. 464: | | | | | |
| Baked beans | 20.85 | [a] 1.41 | 17.22 | 13.56 | 10.59 |
| Other vegetable food | 28.16 | [b] 27.57 | 80.46 | 13.81 | 46.02 |
| Total vegetable food | 49.01 | 28.98 | 97.68 | 27.37 | 56.61 |
| Total animal food | 50.99 | 71.02 | 2.32 | 72.63 | 43.39 |
| Digestion experiment No. 465: | | | | | |
| Baked beans | 23.70 | [a] 1.62 | 15.36 | 15.99 | 12.52 |
| Other vegetable food | 32.93 | [b] 34.34 | 83.08 | 18.16 | 59.42 |
| Total vegetable food | 56.63 | 35.96 | 98.44 | 34.15 | 71.98 |
| Total animal food | 43.37 | [b] 64.04 | 1.56 | 65.86 | 28.06 |
| Digestion experiment No. 466: | | | | | |
| Baked beans | 26.29 | [a] 1.89 | 12.82 | 21.10 | 12.45 |
| Other vegetable food | 40.97 | [b] 49.85 | 86.54 | 32.02 | 71.37 |
| Total vegetable food | 67.26 | 51.47 | 99.36 | 53.12 | 83.82 |
| Total animal food | 32.74 | 48.32 | .64 | 46.88 | 16.18 |
| Digestion experiment No. 467: | | | | | |
| Baked beans | 32.54 | [a] 2.00 | 17.71 | 22.75 | 15.88 |
| Other vegetable food | 36.36 | [b] 37.78 | 81.64 | 30.78 | 60.42 |
| Total vegetable food | 68.90 | 39.78 | 99.35 | 53.53 | 76.30 |
| Total animal food | 31.10 | 60.22 | .65 | 46.47 | 23.70 |
| Digestion experiment No. 468: | | | | | |
| Baked beans | 19.69 | [a] 1.52 | 11.53 | 15.13 | 10.07 |
| Other vegetable food | 38.07 | [b] 46.13 | 87.53 | 35.16 | 68.15 |
| Total vegetable food | 57.76 | 47.65 | 99.10 | 50.29 | 78.22 |
| Total animal food | 42.24 | 52.35 | .90 | 49.71 | 21.78 |

[a] Not including fat added in the form of pork.
[b] Including fat from animal sources used in preparation of food.

As will be seen, the animal foods furnished from about one-third to one-half of the protein and from about one-fifth to nearly one-half of the energy of the diet. Correspondingly, vegetable foods furnished on an average rather more than one-half of the total protein and considerably more than one-half of the total energy. Baked beans were the most important single food, furnishing from one-fifth to one-third of the total protein and from one-tenth to one-seventh of the total energy of the diet.

## NUTRIENTS EATEN PER MAN PER DAY IN THE DIGESTION EXPERIMENTS.

Throughout the periods covered by the different digestion experiments the kinds and amounts of food eaten by each subject were of course recorded, so that the digestion experiments may be regarded as dietary studies also. They differ from the other dietary studies with Maine lumbermen in that the records are made for a single individual instead of for a group. Digestion experiments Nos. 463 to 465

were made at the same time as dietary study No. 393—while the men were engaged in cutting and yarding logs. Digestion experiments Nos. 466 to 468 were made at the same time as dietary study No. 394—while the men were at work drawing logs from the yard to the landing. The quantity of nutrients and energy in the food eaten per man per day during the digestion experiments and the corresponding dietary studies are shown in Table 29, which follows. For convenience in tabulating the records, the digestion experiments are here numbered as dietary studies in series with the other dietary studies.

TABLE 29.—*Comparison of nutrients and energy of daily diet in digestion experiments and dietary studies with Maine lumbermen.*

| Kind of work. | Quantities per man per day. | | | |
|---|---|---|---|---|
| | Protein. | Fat. | Carbohydrates. | Fuel value. |
| CHOPPING AND YARDING. | *Grams.* | *Grams.* | *Grams.* | *Calories.* |
| Digestion experiment No. 463 (dietary study No. 395) | 175 | 226 | 757 | 5,710 |
| Digestion experiment No. 464 (dietary study No. 396) | 206 | 244 | 708 | 6,780 |
| Digestion experiment No. 465 (dietary study No. 397) | 212 | 248 | 927 | 6,760 |
| Average | 198 | 239 | 797 | 6,415 |
| Dietary study No. 390 | 247 | 386 | 944 | 8,199 |
| Dietary study No. 393 | 176 | 388 | 982 | 8,085 |
| Average | 212 | 387 | 963 | 8,140 |
| DRAWING LOGS TO LANDING. | | | | |
| Digestion experiment No. 466 (dietary study No. 398) | 175 | 181 | 958 | 6,075 |
| Digestion experiment No. 467 (dietary study No. 399) | 156 | 189 | 768 | 5,330 |
| Digestion experiment No. 468 (dietary study No. 400) | 147 | 163 | 672 | 4,665 |
| Average | 159 | 178 | 799 | 5,355 |
| Dietary study No. 391 | 179 | 336 | 769 | 6,782 |
| Dietary study No. 394 | 180 | 316 | 839 | 6,888 |
| Average | 179 | 326 | 804 | 6,835 |

In the discussion of the results of dietary studies with the lumber crews as a whole, it was pointed out (p. 31) that the food consumption was larger during the period of severe work of chopping and yarding than during the period of less severe work of hauling logs to the landing. The same is also true for the individuals included in the digestion experiments. Thus it will be seen from the figures above that the minimum for the three subjects of studies during the period of harder work, 175 grams of protein and 5,710 calories of energy, was equal in protein, but a little lower in energy than the maximum, 175 grams and 6,075 calories, during the period of less severe work. The average consumption for the three subjects in the former period was 198 grams of protein and 6,415 calories of energy, as compared with 159 grams and 5,355 calories for the three subjects during the latter period.

The particular interest in the data summarized in the table above, however, is in the comparison between the results of the studies with individuals and those of the corresponding studies with groups during the same period.

While the men were chopping and yarding the quantity of protein in the diet of the three individuals ranged from 175 to 213 grams per man per day, and averaged 198 grams, whereas the average for the group in the dietary study (No. 393) made at the same time was 176 grams. On the other hand, the quantity of energy per man per day ranged from 5,710 to 6,780 calories, and averaged for the three men 6,415 calories, as compared with 8,085 calories for the group. Thus while each of the three individuals consumed as much or more protein than the average for the group, they obtained considerably less energy, because of the smaller amount of fats and carbohydrates eaten. The quantity of fat ranged with the individuals from 226 to 248 grams, and averaged 239 grams, and the carbohydrates from 708 to 927 grams, and averaged 797 grams, whereas in the average food consumption for the group the amounts were 388 grams of fat and 982 grams of carbohydrates.

In the studies made at the time of drawing logs to the landing the quantity of protein in the food eaten by the individuals ranged from 147 to 175 grams and averaged 159 grams, whereas the amount per man per day for the group in the dietary study (No. 394) made at the same time was 180 grams. As regards energy, the range for the studies with individuals was from 4,665 to 6,075 calories, and the average 5,355 calories, as compared with 6,836 calories per man per day for the group. In this case each of the three individuals ate less protein than the average for the group. They also ate much smaller quantities of fat. As regards carbohydrates, one man ate considerably less, one only a little less, and one considerably more than was found in the average for the group.

The reason for these discrepancies between results of dietary studies with groups and those with individuals under the same circumstances is not easy to determine. As already noted, the subjects of the digestion experiments were selected because they were believed to be typical of the men in the dietary studies. They ate in the same room and at the same time with the rest of the crew, although at a separate table, and were served with the same kind of food, being allowed to select such kinds and amounts as their appetites dictated. If other men had been chosen for the digestion experiments it is possible that the agreement with the average results of the dietary studies would have been closer; but, of course, this is a matter of conjecture only. The discrepancies noted would suggest the question as to which results should be considered most representative of the normal food consumption of the men under the conditions of these investigations. It

is quite generally believed that the values per man per day as obtained in dietary studies with large groups more nearly represent the requirements of the average individual in the same circumstances than do the results obtained with a single individual considered a fair representative of the group, though there are those who believe that the experimental conditions may be more carefully controlled and that thus greater accuracy is possible when the experiment is limited to a single individual. In this instance, however, both dietary studies and digestion experiments were carefully made, and the results in both cases are believed to be reliable. It is believed also that all the men consumed as much food as they needed. In such a case the inference would be that as regards amounts eaten the men selected were not as typical as was anticipated of the whole group, since the majority consumed larger quantities of fats and carbohydrates than they did. The results afford an excellent illustration of the difficulty in estimating food consumption without actual weighing.

## CONCLUSIONS.

These dietaries of Maine lumbermen are, as regards protein and energy, the highest yet recorded for any class of American laboring-men, with the exception of a very small number reported for teamsters and brickmakers at severe labor. The large amounts of food eaten must be attributed in great part to the severe labor in the open air and the cold to which the men were exposed.

Whenever the labor was less continuous, as in the case of the teamsters when engaged in hauling for long distances, the amount eaten became noticeably less. Although the work of river driving is severe, calling for long days and often obliging the men to work while wet with icy water, yet it was found that under these conditions they ate less than when cutting in the woods. This was probably due in part to a less varied diet and in part to the unfavorable conditions under which the food was eaten. In the case of the men engaged in chopping and yarding the amount of protein consumed was considerably in excess of that called for by the commonly accepted dietary standard. The energy furnished by the same dietaries was also far in excess of the amounts called for by the standard for very hard muscular work. Since these conditions were not accompanied by any increase in the weight of the subjects, it is not probable that the diet was greatly in excess of their needs.

The cost of food per person per day during these experiments ranged from 15.1 to 28.6 cents and averaged 23.5 cents. On an average about two-thirds of the total expenditure was for animal food and about one-third for vegetable food.

In the digestion experiments the results obtained with the different subjects were on the whole very uniform, the protein and other

nutrients being in all cases quite thoroughly digested and about 93 per cent of the energy of the diet being available. Considered as a whole the results agree quite closely with the average values obtained in a large number of American experiments made under widely varying circumstances. As has been observed in other experiments, when corrections for metabolic products, obtained by the pepsin method, are introduced the coefficients of digestibility of protein are higher than when the corrections are obtained by the ether, alcohol, and limewater method.

During the digestion experiments it was found that animal foods furnished from about 33 to 50 per cent of the protein and from about 20 to nearly 50 per cent of the energy of the diet. Baked beans furnished from 20 to 33 per cent of the total protein and from 10 to 14 per cent of the total energy of the diet.

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